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CONCEPTUAL DESIGN OF A CYBERNETIC INFORMATION SYSTEM FOR COMMAND AND CONTROL

by

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The proposed system would use advanced, but existing, information technology, incorporating cybernetic models, to enhance a decision-maker's control process. It does this by collecting, processing, and fusing all-source data for presentation to a decision-maker. Natural Language Processors categorize, filter, and fuse relevant data while advanced visualization engines display that data in a way that improves a decision-maker's ability to rapidly assimilate information, and increase knowledge and understanding.

This thesis shows that using cybernetic models, and advanced Artificial Intelligence tools, a design exists that could help increase understanding and control by improving the decision-making process and shortening the decision-maker's OODA Loop.

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I would like to thank my mother and father for instilling in me a desire to learn and for all their love and guidance. I would especially like to thank them for encouraging me to pursue this, and every, educational opportunity. Additionally, I would like to express my sincere thanks to Major Nelson Ludlow, United States Air Force, for his guidance. This thesis would not have been realized without Major Ludlow's passion, which I absorbed, for this topic. I am also grateful to Professor Hemant Bhargava of the Naval Postgraduate School and Dr. Daniel Howland for their encouragement, expert advice, and guidance. Finally, I offer my greatest thanks to my wife, and best friend, Tammy, as well as my two young sons, who made it possible for me to not only complete this tour, but also to enjoy it immensely.

I. INTRODUCTION

This thesis investigates how the application of cybernetic modeling and analysis techniques, coupled with emerging information technology, can aid in deterrence through increased control. In short, this thesis presents a concept that improves the decision making process and helps shorten the decision-maker's OODA loop. This ideally allows the decision-maker to make faster, and hopefully better, decisions and most importantly, retain control of the situation.

A. BACKGROUND

The threat to United States security has changed dramatically in the last several years. The Cold War ended and with it so did the specter of the nuclear annihilation of the world's population in an East-West confrontation. The once mighty and feared Soviet Union, with its threatening goal of world hegemony through Communist rule, has dissolved. The time to relax and rejoice, however, was short. The demise of the main threat of the past fifty years was replaced by the threats posed by regional powers and non-state organizations (NSO's), unaligned with, and uncontrolled by, any influential superpower. Common wisdom holds that "accelerating rates of change will make the future environment more unpredictable and less stable, presenting our Armed Forces with a wide range of plausible futures." [JV2010-96] In a sense, the threat has become more complex and dynamic than ever.

The U.S. government has many goals. Several of these goals include: 1) protecting the lives and safety of Americans at home and abroad; 2) maintaining the political freedom and national independence of the U.S. with its values, institutions, and territory intact; and 3) providing for the well being and prosperity of the nation and its people. These goals generate American interests that in turn may become threatened. "In sum, the United States must prepare to face a wider range of threats, emerging unpredictably, employing varying combinations of technology, and challenging us at varying levels of intensity." [JV2010-96] To counter these threats the U.S. government generates specific foreign and security policies based on information that it possesses. The U.S. intelligence community exists to provide accurate and meaningful information to military leaders and government decision-makers. To be accurate and meaningful, the information must be relevant, timely, useful, and understandable to the leaders and government decision-makers. The accumulation of data, its transformation to information and its use when applied through knowledge and wisdom is paramount to the successful formulation and implementation of policy and action.

The rapid growth in telecommunications and information technology has allowed organizations to gather tremendous amounts of data on subjects of interest. This fact, rather than a boon to the people who must analyze and decide, is often detrimental. The result of the increased availability of data often leads to data overload. The amount of data available to process has become an obstacle. "The challenge of the future for the war fighter is not going to be getting information but how to sort out the appropriate

information from the overload of incoming data."[Sheehan97] An abundance of data must be examined to discover critical pieces of information.

To be useful, accurate information must quickly be assimilated from the data available. The information must then be provided as intelligence to leaders in a timely manner so the threats to security can be mitigated. "Before an organization can develop and introduce effective responses to external or internal threats or disturbances, it must have accurate and effective information that defines the nature of these threats and outlines a broad array of potential responses." [Jenner94]

The command and control (C2) decision making process, as explained by Colonel Boyd [Boyd87], consists of four phases: Observe, Orient, Decide, and Act. These phases, when combined, form the OODA loop. The OODA loop drives decision making and implementation in peace, crisis and wartime. Sensors, either organic, inorganic or a combination, observe reality. Processors and displays help decision-makers visualize and orient themselves to the observed events. Perceptions lead to intentions and decisions on some course of action. Finally, after the decision comes execution, or the act. Completing the OODA loop faster than your opponent puts you in control of the situation. The ability to couple the benefits of technology with a good model for analysis will improve the C2 decision making processes and compress the time to complete the OODA loop. Figure 1.1 depicts the OODA loop model.

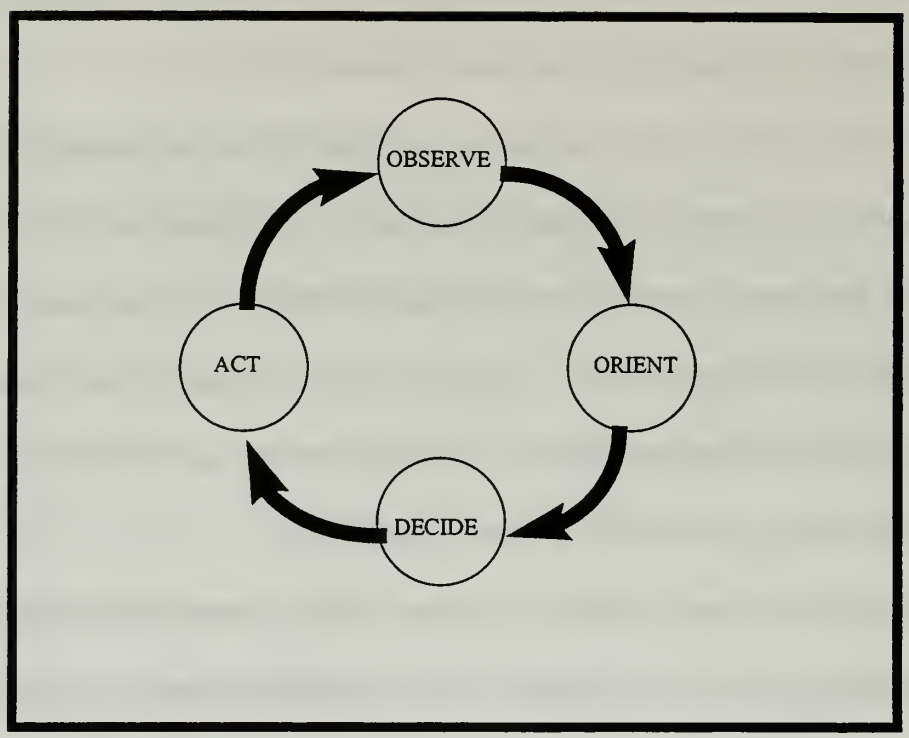

Figure 1.1 OODA Loop Model

Finally, coupled with the new threat and obstacle is the reality of a diminishing defense budget. Today's war cry has become "Do more with less." An ability to economically provide the accurate and timely information required by leaders is essential to answering this cry. The primary task of the U.S. Armed Forces is to deter conflict. Its secondary task is to fight and win wars if deterrence fails. A great deal of effort has been poured into ensuring we can accomplish the secondary task. This thesis calls for attempting to improve the primary task of conflict deterrence through the improvement of the prediction and control process involved in traditional Command, Control, Communications, Computers and Intelligence (C4I) systems.

Decision-makers can be given all available information on a situation and yet understanding still entails knowing why some event transpires or why opponents act. Knowledge transcends the simple possession of information. Knowledge includes understanding the reasons behind event occurrence. C2 systems must have the capability to aid decision-makers in their goal of understanding, or higher cognition. "Actions, visualization, collection and correlation drive the C2 engine toward understanding. Ascending the cognitive hierarchy will allow decision makers to create strategy, plan missions and rehearse based on an understanding of how the enemy is thinking." [JV2010-96]

To ascend the cognitive hierarchy information must be interpreted and applied correctly. Information is useful and has value when "it contributes to knowledge and understanding. War-fighters understand things best in terms of ideas or images." [JP6-0-95] This thesis presents a way for the decision-maker to ascend the cognitive hierarchy through cybernetics. Figure 1.2, on the next page, illustrates the cognitive hierarchy.

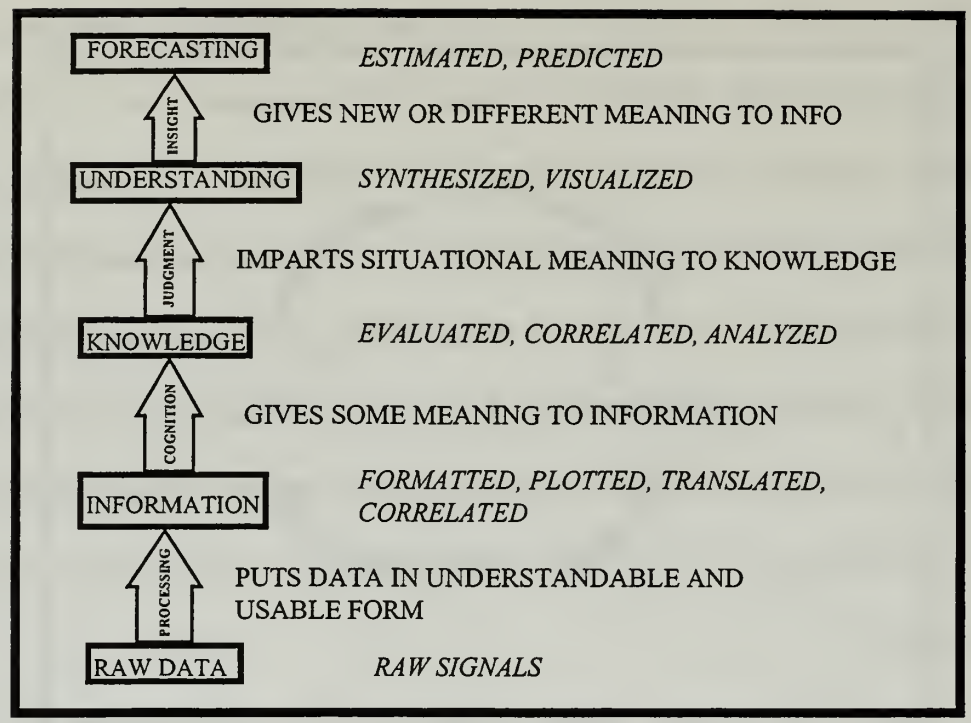

Figure 1.2 Cognitive Hierarchy
[adapted from MCCP]

Cybernetics is a systematic view of a situation over time. It allows one to look at an entire system and how it works together vice breaking it apart into smaller pieces and taking a mechanistic look at the individual parts and how they work. With cybernetics one deals with the set of all possibilities.

Control is a process that attempts to eliminate variety and uncertainty from a system. If variety is limited, then uncertainty is limited. Consequently, the limiting of these two factors, or variables, makes the system approach some form of equilibrium, or homeostasis. Therefore the system is under control or in the process of being controlled, or regulated. Cybernetics allows for better control of complex systems through the use of information to regulate the system.

This thesis examines existing C2 systems and briefly outlines their capabilities and functions. This thesis also explains what is desirable in a C2 system. This examination allows for the description of a goal architecture for a proposed C2 system. In this case, that system will be a conceptual design of a Cybernetic C2 system.

Additionally, this thesis examines existing technology that may be useful in designing such a system and identifies areas that require improvement (or have yet to be designed or developed). Data on existing technological capabilities, compatibility and availability with the proposed system are presented and evaluated.

B. RESEARCH QUESTIONS

In determining if, and how, the decision making process could be improved, my research focuses on the areas of the feasibility and benefits of cybernetics. Specifically, this work proposes a conceptual model for a Cybernetic Information System to aid decision-makers in their efforts in command and control.

To aid in this effort, this research is concentrated around the following research questions:

1. **How can cybernetics be used for command and control?**
2. **What are the advantages and disadvantages of using cybernetics?**
3. **What are the hardware, software and data requirements for establishing a Cybernetic Information System?**

These primary questions in turn raise several more secondary questions requiring answers. The secondary, or subsidiary questions are:

1. **What data will be required for system operation?**
2. **What is the best representation for providing the required data for analysts' interpretation?**
3. **How can a system enhance control of a situation?**
4. **How can the system aid analysts in recognizing bifurcation points and what benefit would early recognition provide?**
5. **What impact will the system have on current capabilities for command and control efforts?**
6. **Can a cybernetic system allow one to predict, forecast and recommend courses of action?**
7. **How can pattern recognition capabilities of analysts be improved beyond current capabilities?**
8. **How can the system focus the analysts' time, currently spent on the minutiae of reading and plotting data, to allow more time for pattern recognition, prediction and steering recommendations?**
9. **How can existing technology be integrated and used in the system?**

C. SCOPE AND METHODOLOGY

The author designs this system conceptually on paper and presents a problem for solution. The solution is presented, as it might actually appear, if the conceptual system in fact existed. The actual data used to validate the model was collected via open sources (news articles, CNN, magazine articles, etc.).

The decomposition of the data flow into the system and how the data is used and displayed is provided to promote insight into many of the research questions presented.

The displays either confirm or refute the questions pertaining to aiding pattern recognition, recognizing bifurcation points and enhancing control of a situation.

The proposed system architecture is analyzed and designed based on the data flow diagrams presented in following chapters. The final system outputs (graphs, reports and screen displays) are created and evaluated with their respect to usefulness in aiding understanding and control.

D. ORGANIZATION OF STUDY

Chapter II, "Existing Technology and Cybernetics", describes various existing C4I systems and technology. The chapter addresses questions of why C4I systems are needed, what their functions are and what their functions should be. Existing artificial intelligence technology and applications that may be useful in a Cybernetic C2 system are discussed. Finally, cybernetic theory is introduced and briefly explained. The value, limitations and general examples of cybernetics is described.

Chapter III, "The Cybernetic C2 System", contains this central thesis idea. Specifically, it formally proposes the new system. It describes the functions of the system and how it might be implemented. A brief concept of operations for the proposed system is also included. Also, included is a design for the system using existing technology where feasible and identification of components needed, but not yet existing.

Chapter IV, "System Design", describes the design showing Data Flow Diagrams of the conceptual system. It includes descriptions of the processes involved in the system and the technology required.

Chapter V, "System Implementation", provides the description of the test problem and system operation. Explanation of how and why the data was gathered for this thesis is discussed. I will use the data and manipulate it as an actual system might and present the outputs and conclusions.

Chapter VI, "Conclusions", addresses the systems merits and faults. It re-addresses the primary research questions, summarizes this work, and provides guidance to others for areas requiring further research.

II. EXISTING TECHNOLOGY, ARTIFICIAL INTELLIGENCE AND CYBERNETICS

A. C4 SYSTEM FUNDAMENTALS

Command and control is defined in Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms as:

> *The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission.*

C4 Systems exist to aid the decision-maker in accomplishing the command and control function. The C4 systems aid in completing those functions by offering the continuous and uninterrupted flow of data, for processing, to support the decision-makers planning, decision, execution and monitoring stages. A C4 system's foundation is built on increasing data and information accessibility.

A C4 system is the "principal tool used to collect, transport, process, disseminate and protect data and information"[JP6-0-95]. Its fundamental objective is to get the right information to the right person at the right time, so that good decisions can be made and

executed. Recalling Boyd's OODA loop, the system must support faster decision cycles to be beneficial to the user.

The bottom line, on why C4 systems exist, is that victory results, more often than not, when a decision-maker makes good decisions and executes them quicker than his opponent. Victory demands the linkage of timely execution to good decisions through proper command and control.

More specifically (according to Joint Pub 6-0 Doctrine for Command, Control, Communications, and Computer (C4) Systems Support to Joint Operations) C4 systems have several objectives:

> **Produce Unity of Effort**. C4 systems should help a military force and its supporting elements to combine the thoughts and impressions of multiple commanders and key war-fighters to allow the views of many experts to be brought to bear on any given task.
>
> **Exploit Total Force Capabilities**. C4 systems must be planned as extensions of human senses and processes to help the commanders form perceptions, make decisions, and react. This allows commanders to be effective during high-tempo operations.
>
> **Properly Position Critical Information**. C4 systems must be able to respond quickly to requests for information and to place and maintain that information where it is needed.

Information Fusion. Fusing of information produces a picture of the battlespace that is accurate and meets the needs of war-fighters. If they have concise, relevant, accurate and timely information, unity of effort is improved and uncertainty is reduced. This enables the forces as a whole to exploit opportunities and fight smarter.

The physical components that constitute a C4 system (JP6-0-95) are:

Terminal devices such as telephones, fax machines, and computers are the most recognizable components of most C4 systems. Generally speaking, terminal devices transform information from forms comprehensible to the war-fighter into format for electronic transmission, or vice-versa.

Transmission media connect terminal devices. There are three basic electronic transmission media: radio (including space-based systems), metallic wire, and fiber optic cable. Paths may be point-to-point if established between just two users, or they may be point-to-multipoint if the same path serves a community of subscribers.

Switches route traffic through a network of transmission media. Switching may be manual or automatic; it may serve local subscribers or perform area network functions. There are basically two types of switches: circuit and message. Circuit switches generally support telephone traffic while message switches process data transmission.

There are two basic levels of control: **network and nodal**. Network control provides management of area, regional, theater, or global networks. Its principle focus is in the management and configuration of long-haul transmission media and switching centers transporting and routing bulk data between nodal facilities. Nodal control is concerned with the management of local C4 systems. Its principle focus is in the switching systems and terminal devices supporting warriors at locations such as command centers or C2 facilities.

Additionally, C4 systems are required to provide the mandatory capabilities described in Figure 2.1.

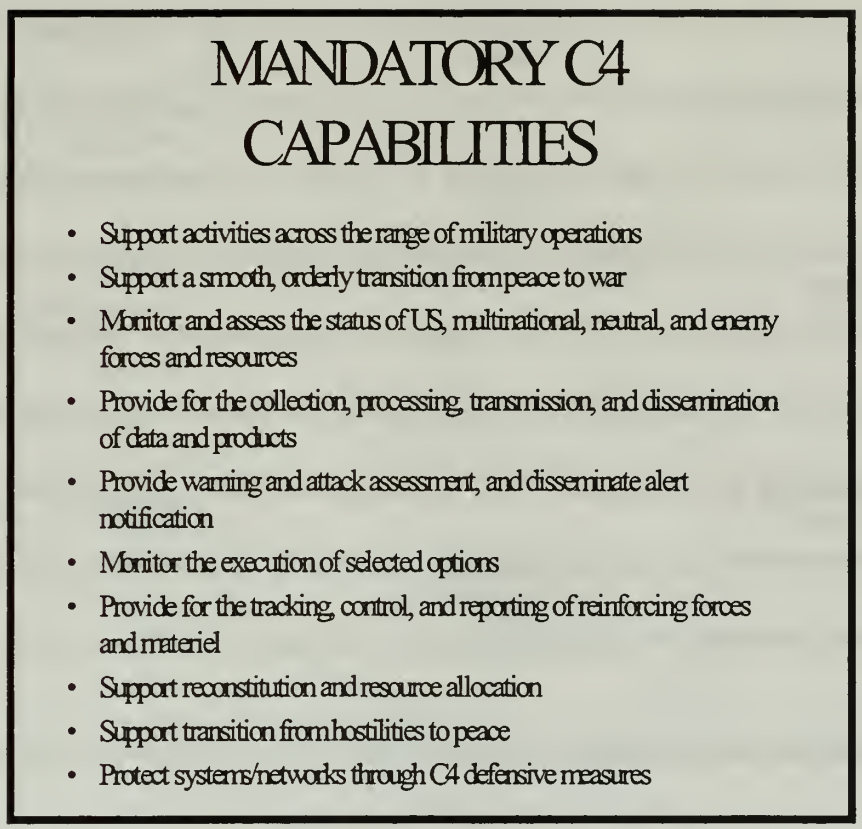

Figure 2.1 Mandatory C4 System Capabilities
[JP6-0-95]

The mandatory capabilities required in C4 systems ensure the design and implementation of viable systems according to DOD standards. C4 systems are required to be useful (and usable) across the full spectrum of conflict. That means it can, and will, be used during peacetime as well as during a full-scale conventional war (and at any level between the two, e.g. Operations Other Than War, Low Intensity Conflict, etc.). Coupled with this is the requirement that the system be capable of transitioning between the different levels in an efficient manner. Without this capability the system would hinder the decision-maker as time and effort was spent in reconfiguration of the system. C4 systems must also give the decision-maker the capability to monitor and assess resources and disturbances in the environment. The C4 system must collect, process, and transmit data and products as well as provide warnings to the user. It must allow the decision-maker to monitor the execution of his decisions and the outcomes of these actions.

B. EXISTING C4 SYSTEMS

The military's C4I system is a true system of systems. It contains C4I systems, support systems, and programs. The combination of these systems is described as the Military C4I System. An overview of the Military C4I Systems is presented in Figure 2.2.

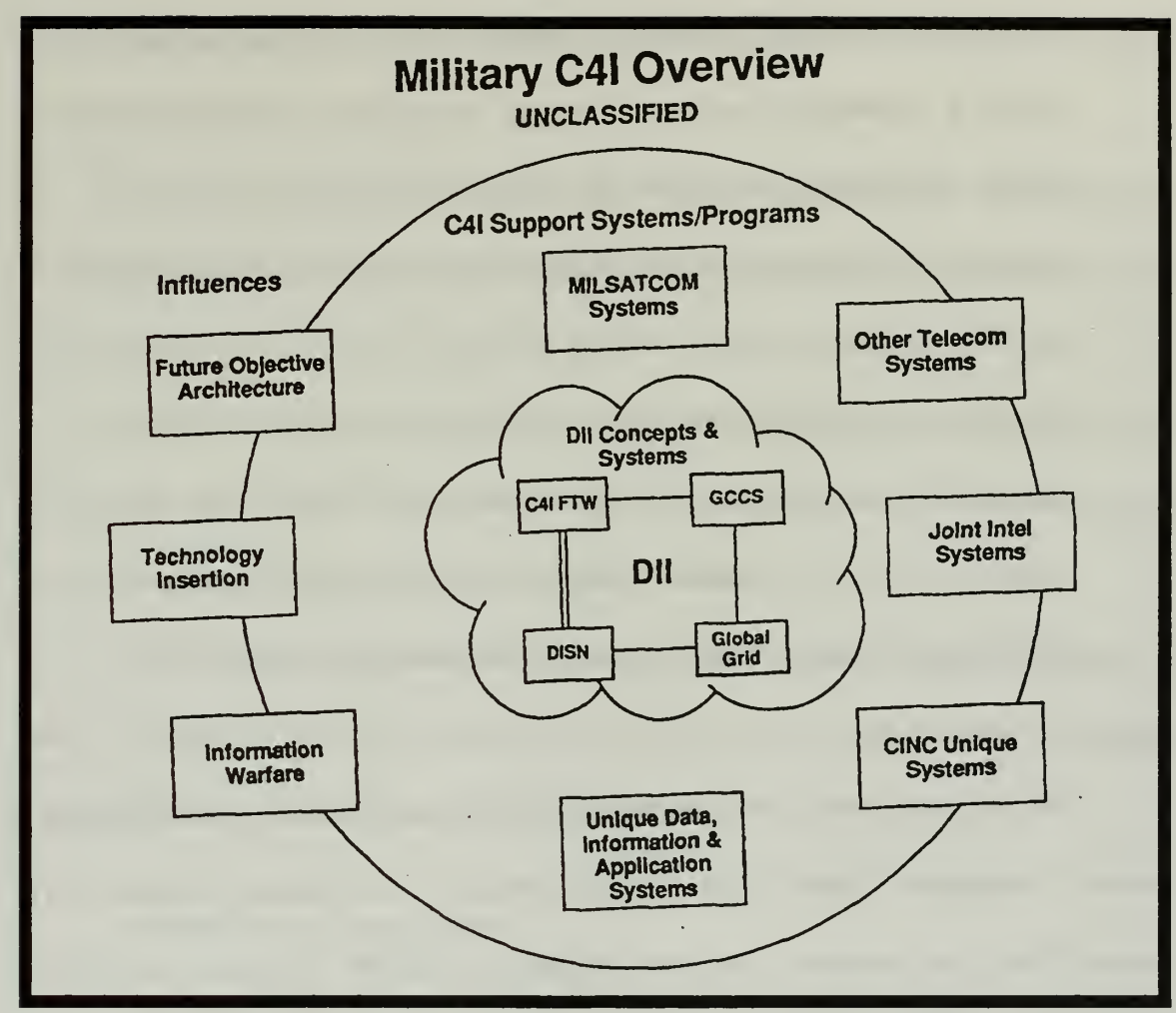

Figure 2.2 Military C4I Overview
[JC4-95]

Central to Military C4I is the Defense Information Infrastructure (DII) and its components: C4I For the Warrior (C4I FTW), Global Command and Control System (GCCS), the Defense Information Systems Network (DISN), and the Global Grid. According to the Assistant Secretary of Defense (C3I), in a memorandum of information definitions, the functions of the DII were explained to be:

The DII encompasses information transfer and processing resources, including information and data storage, manipulation, retrieval, and display. Specifically, the DII is the shared or interconnected system of computers, communications, data , applications, security, people, training and other support structure, serving the DOD's local and worldwide information needs. The DII (1) connects DOD mission support, command and control, and intelligence computer and users through voice, data, imagery, video, and multimedia services; and (2) provides information processing and value-added services to subscribers over the DISN.

The first component of the DII, *C4I For the Warrior*, is a concept with the goal of focusing independent efforts of many people toward a set of shared objectives. The concept links, and supports, personnel engaged in military operations in dynamic environments. When complete it will bring accurate, complete, timely, detailed, and clear information to the user.

The Global Command and Control System, the second component of the DII, provides the capability to move combat, and supporting, forces anywhere at anytime and to provide them with the information they need to achieve their objectives. GCCS is a system of systems that include planning and assessment tools which operate in a networked common operating environment. The core functions include support for crisis planning, force readiness and deployment status, intelligence, and narrative information.

These functions provide a "fused, near real-time, true picture of the battlespace"[JC4-95] for decision-makers.

The third component, the DISN, is the DOD's telecommunications infrastructure. It includes both local and wide area networks that help support C2, intelligence, and other functions.

The final component of the DII is the Global Grid concept. When completed the Global Grid will provide decision-makers the ability to access any information entering the grid, at anytime and anywhere, to aid in their mission.

Appendix A, C4 System Descriptions [JC4-95] includes further descriptions of other C4 systems if the reader wishes to become more familiar with the general functions and capabilities of existing, and planned, C4 systems.

C. FUTURE OF C4 SYSTEMS

A general review of the numerous C4 systems in existence, and the concepts for improving these systems (C4I FTW, Joint Vision 2010, Copernicus, etc.), confirm the fact that the majority of these systems are designed and built for the military to accomplish its secondary task of fighting and winning wars. Little exists in the way of C4 systems that aid decision-makers in accomplishing the military's primary task of deterring conflicts. Tomorrow's C4 systems must attempt to support the decision-maker in identifying and controlling the situations before they lead to conflict.

D. ARTIFICIAL INTELLIGENCE

A common definition of Artificial Intelligence (AI) is "that field of computer science concerned with designing intelligent computer systems, that is, a computer system that exhibits the characteristics we associate with intelligence in human behavior." [Barr81] AI technology is constantly being improved and applied in modern projects. AI might not be the solution in and of itself but many AI functions improve the functionality and add value to systems. The value added is normally the extra flexibility afforded by the computer in relieving human operators from performing tedious, difficult, or time-consuming tasks. AI is also beneficial in a sense that, as mentioned earlier, it can be another part brought to bear on problems at hand. It can be a lever for the decision-maker, increasing his ability to compress his OODA loop and therefore to better control a situation.

1. Examples Of AI Applications

There are hundreds of examples of the application of AI in existence. I have chosen several as representative of current capabilities and cutting edge applications.

Pilots Associate (PA): [Simpson88] Combines developments in expert systems and speech recognition. It is a conceptual project demonstrating the value added by providing the approximation of an additional crew member for single pilot fighter planes. The system's long term goal is the ability to relieve a pilot of all functions except that as

a systems manager. The system would handle the massive information intake and processing of data into information for use by the pilot.

Force Reallocations Expert System (FRESH): [Simpson88] An operational prototype of a C4 system supporting decisions in force reallocations and capability assessment. It possesses a large knowledge base (5-8 thousand rules) and incorporates a natural language interface. One example of the value added nature of this AI system was the capability of a staff (of less than normal size) to respond to a contingency. The staff was able to accomplish, in seven hours, the same task that previously took a fully manned staff seven days to accomplish.

Strategic Computing Object-directed Reconnaissance Parallel-processing Image understanding System (SCORPIUS): [Simpson88] Focuses on automating visual recognition functions of reconnaissance images. It exploits AI technology in the areas of uncertainty management, symbolic representation, and knowledge acquisition.

Modele d'Aide a la decision par le Traitement de l'Information Symbolique (MATIS): [Canamero96] MATIS is a French military C4I system which incorporates knowledge acquisition, design, and plan recognition functions. MATIS can anticipate situations by referencing knowledge it has previously obtained and make recommendations to a decision-maker. It acts as tool for extending the users cognitive level.

Predictive ANalysis System (PANS): [Abramson94] Helps intelligence analysts recognize patterns of activity, match patterns against expected behavior, and predict future courses of events. PANS helps analyze long-term trends and also offers an

application that allows analysts the ability to enter hypothetical data to model 'what if?' scenarios.

Parallel: [Chung94] A natural language processor that exploits parallel processing of computers. Parallel utilizes a preprocessor, phrasal parser, memory-based parser, knowledge base, and template generator to process written material and output summaries in pre-specified templates.

Text to Pictures Systems: [Ludlow92] Generate pictorial representations from narrative texts. These systems are exploiting the idea behind the saying "a picture is worth a thousand words" to help users understand the meaning, or ideas, conveyed in large narrative texts through a simple, quick glance at a picture instead.

Intelligent Agents: [Whitebread95] Used for information discovery in networks and distributed systems. Intelligent agents are programs (or entities also known as 'softbots') that seek out specific information, on their own, after being tasked by a user. This allows a user to perform other functions while his intelligent agent is gathering data for future use. The user can now spend his time on analysis of the data to help make good decisions instead of spending an inordinate amount of time searching for the data.

Genetic Algorithms: [Bhargava97] Allow users to perform comprehensive searches over vast amounts of data at a low cost. It accomplishes this by choosing the most viable hypothesis, or attributes, on which the search should be conducted.

AI techniques that can be applied to aid in the C2 process are my primary concern for this thesis. Several of the applications described above contain AI features that if properly combined, would be useful in improving the C2 process. Applications such as

Natural Language Understanding/Processing (NLU and NLP), machine learning, pattern and voice recognition, intelligent agents, and advanced visualization techniques can all be exploited for use in a C4 system. Much of the basis for the Cybernetic system incorporates AI applications and concepts. The reason AI is so attractive for inclusion in the Cybernetic system is because cybernetics, which deals with sets of possibilities, requires immense computational resources and intelligence.

E. CYBERNETICS

This thesis demonstrates the improved command and control capabilities afforded decision-makers through cybernetic modeling and analysis techniques. The following sections describe cybernetic theory, applications, limitations, and benefits and explain why I have chosen it as the tool/methodology for improving the C2 process.

1. Cybernetic Theory

Models are abstractions. They allow humans to simplify their world, reduce complexity, and increase their understanding. When something is understood better that normally conveys a sense that the information is better. Better information equates to better decisions and making better decisions is half of the C2 challenge.

Cybernetic modeling is an empirical process. Large quantities of data must be processed to develop, test, and use the models. The models provide a framework for organizing and displaying data so that an investigator can detect behavioral patterns, which explain the past, describe the present and forecast the future. [Howland90]

Cybernetics, as defined by it modern day founder Norbert Weiner, is "the science of control and communication, in the animal and the machine." Its themes are coordination, control and regulation.

"Cybernetics envisages a set of possibilities much wider than the actual, and then asks why the particular case should conform to its usual particular restriction...What is important is the extent to which the system is subject to determining and controlling factors." [Ashby84] This last concept, the extent to which a system is subject to control, is what is of interest. The ability to increase control is the Holy Grail for decision-makers and the object of this thesis.

"Cybernetics offers a method for the scientific treatment of the system in which complexity is outstanding and too important to be ignored." [Ashby84] Observers are either incapable of, or unwilling to, vary the factors one at a time in complex systems. The factors are too interrelated for such manipulation. Cybernetics provides the means to analyze such a complex system.

The basic concepts of cybernetics [Howland88] are:

1. Cybernetic models describe the behavior of control systems. They comprise a "controller," which specifies system goals, and a "control object."

2. Adaptive systems are open, interacting with their environments. They must be able to modify structure and function to adapt to environmental change.

3. The state that a system is in at any point in time depends on past states and the goal state specified by the "controller."

4. System performance is monitored in time, and information on actual performance is fed back to a comparator, which contrasts what is happening with what is wanted.

5. Resources are allocated as required to insure that actual system performance is within the limits specified by the controller.

6. The range of adaptability is limited by the variety of available resources. If the system is subjected to a variety of environmental disturbance, but has a limited variety of resources, its adaptive capability is limited.

7. The lowest levels of the system must be able to function autonomously because centralized control is limited. Man, for example, has both a central and autonomic nervous system. The autonomic system controls variables such as blood pressure, body temperature, and blood sugar level. The central nervous system is not involved at this level of control unless the autonomic system malfunctions.

Cybernetics, though very powerful, does have some limitations. First on the list is a general misunderstanding of the very concepts that make cybernetics so powerful.

Cybernetics is useful for understanding complex, dynamic, adaptive systems. It can provide information necessary to control a system and guide it to some goal state. It is not as useful when, compared to other models, it is applied to stationary, less complex systems or problems. For these problems, physics or operations research techniques usually are better.

The requirement for enormous computational resources, coupled with the need for some forms of AI, was also limiting to cybernetics. This, however, is no longer the case. Computer users of today encounter a relatively new problem: data overload. Currently, hardware and software for user interface have the ability to deliver data in a multitude of forms and variety. The user can be overwhelmed with data. Fortunately, developments in high-speed processors and the ability to network computers have opened the door to an enormous amount of computational power. The power once reserved for the mightiest of mainframes now can reside in networked desktop personal computers. Users now possess the ability to harness and exploit the computational power required for data intensive analysis. The ability to satisfy the need for extensive gathering, filtering, processing, and displaying of data for the cybernetic model to be of benefit to a decision-maker now exists.

Cybernetics is currently being applied in several specific areas. These areas include most systems that require an intake of data about their surrounding environment (monitoring), an understanding of that data, and an ability to use that data to adapt to their surroundings. Examples of these systems include walking robots, driver-less automobiles, and unmanned space craft.

2. Why Choose Cybernetics?

As I explained in the background of the Introduction, the task facing decision-makers is to counter threats that are becoming more complex and dynamic. How does a decision-maker counter the increasing variety of threats? The answer is found in the Law of Requisite Variety. Understanding this law compelled me to choose cybernetics for improving the decision-makers abilities.

The Law of Requisite Variety states that only variety can destroy variety. That is, solutions to problems increase in ease as the number of solutions approach, or exceed, the number of problems. The mores choices you can have when attempting to counter threats allows for better decisions made and better actions taken. Better command and control is essential to increasing the variety of choices, or resources, available for a system to succeed and survive.

The interactions of parts within a Complex Adaptive System (CAS) make the system behave in what appears to be a highly complicated, unpredictable and seemingly uncontrollable manner. It is often difficult, or impossible, to isolate individual causes and effects in a CAS. "The behavior of complex adaptive systems is frequently nonlinear-which means that even extremely small influences can have decisively large effects, or vice versa-and often chaotic. The element of chance, interacting randomly with the various parts of the system, introduces even more complexity and disorder."[MCCP] Thus the variety of disturbances existing in a CAS can be enormous.

Cybernetics offers decision-makers increased understanding of complex systems, increases the variety of resources available, and provides better understanding of why the system is behaving as it is. The next chapter proposes the adoption of a cybernetic model for a command and control system.

III. THE CYBERNETIC C2 SYSTEM

I have briefly explained how cybernetics is valuable in improving a decision-maker's understanding of a CAS and how situations facing governmental and military decision-makers are becoming more complex. This combination, therefore, makes the application of cybernetics in C4 systems a viable, if not desirable, option. The task now at hand is how to incorporate cybernetic tools and methodology into a C4 system that improves the C2 process.

The United States Marine Corps' view of C2 is a dynamic view which "sees command as the exercise of authority and control as feedback about the effects of the action taken." [MCCP] The Cybernetic C2 system exploits AI technology to increase the decision-makers understanding, and hopefully control, of a situation. "Control is provided by feedback-the continuous flow of information about the unfolding situation returning to the commander." [MCCP]

Howland proposed a large decision support system. His system, figure 3.1, is an "automated feedback control system with information channels connecting the decision makers and the 'real world.' Information in these channels is used to monitor and control the situation. The automated decision support system is designed to transform textual data into pictures which can be searched visibly for mission-threat-resources patterns." [Howland90]

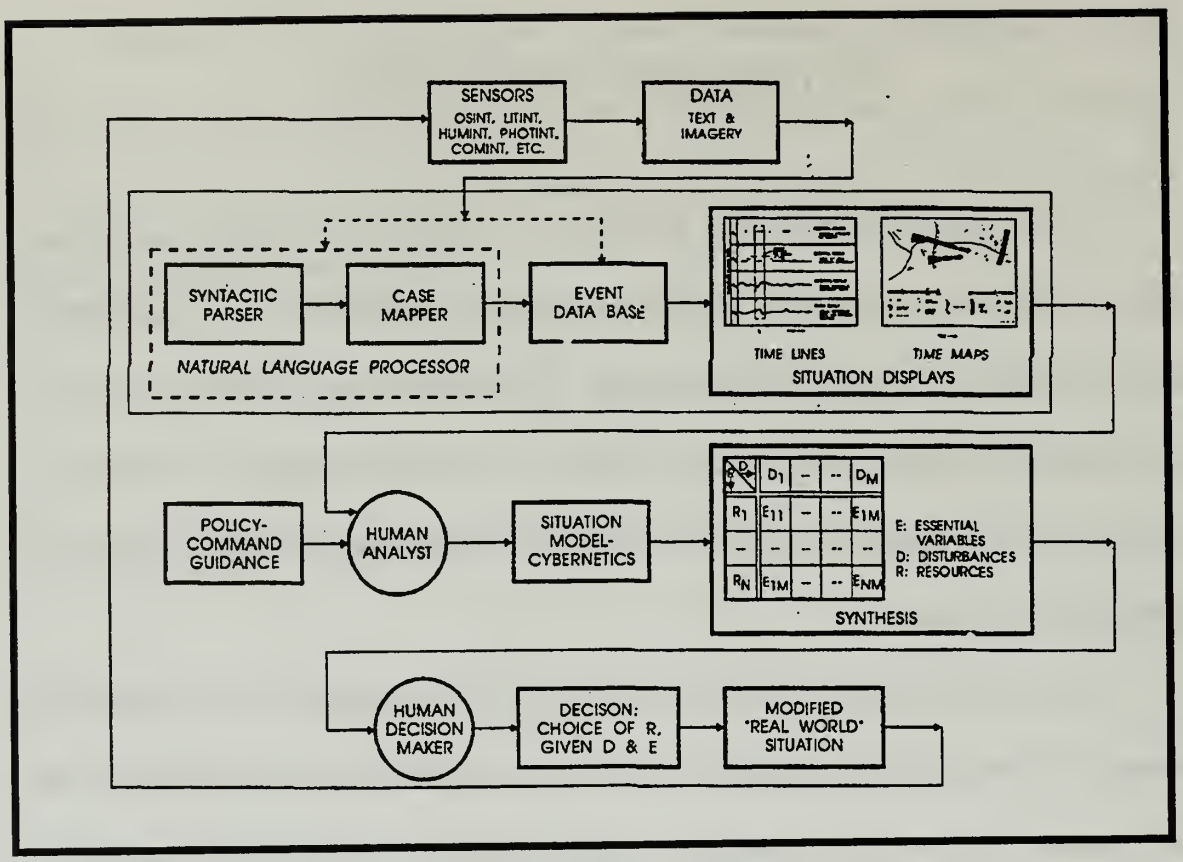

Figure 3.1 Howland's DSS

My proposed C2 system builds upon Howland's framework and expands his ideas. The following section describes a brief concept of operations for the conceptual system.

A. CONCEPT OF OPERATIONS

A situation, or event, is continuously monitored through the collection of data on that event. The data is collected through a variety of means (open sources, other C4 system inputs, user inputs, intelligent agent search results, etc.). The more variety in the inputs the better the information (i.e. Law of Requisite Variety).

The data is stored in its original retrieved, unprocessed form. This constitutes the first, or raw, form for the data. No processing or analysis has been conducted. The raw

form is then processed (via natural language processors) and stored in its second, or parsed, form. This stage also synthesizes data to combine similar data and decrease data overload for the decision-maker.

The parsed data is further processed, disseminated and displayed as timelines, maps and reports (either full or summaries according to a pre-specified template).

Utilizing several AI tools and exploiting cutting edge technology, much of the parsed data is used by the system, and decision-makers, to identify patterns. These patterns, when cognized, help the decision-maker improve his decision and compress his OODA loop.

This section illustrates the way this system would work if it were actually built and operational. I will step through the operation of the system, following the outline of the concept of operations outlined above, as it would apply to the real world situation occurring in Bosnia in the July-August 1995 time frame. Chapter four outlines the system design and chapter five contains the examples of possible inputs, outputs and interpretations of the same real world event.

B. BASIC/TOP LEVEL DESIGN

The most basic representation of an information system, and its interaction with the real world, is illustrated in Figure 3.2. At the lowest level any information system can be modeled in this manner. The components of a system are simply:

1. **Input Devices**: These devices are the means for getting the data into the system. They connect the outside world, and the user, to the system. Keyboards, microphones, and digital scanners are the most common physical devices for inputting data.

2. **Processors**: These are the brains of the system. Processors accept the input, perform some function, or process, and produce an output.

3. **Output Devices**: Like input devices these components connect the system to the user. They provide the interface between the system and the user so that the processed data can be viewed. Common output devices are video screens, printers, and speakers.

4. **Memory**: This is the system's accumulated knowledge. It is a history of operations performed and results tabulated. This memory is used to compare new data against old. Memory devices include databases.

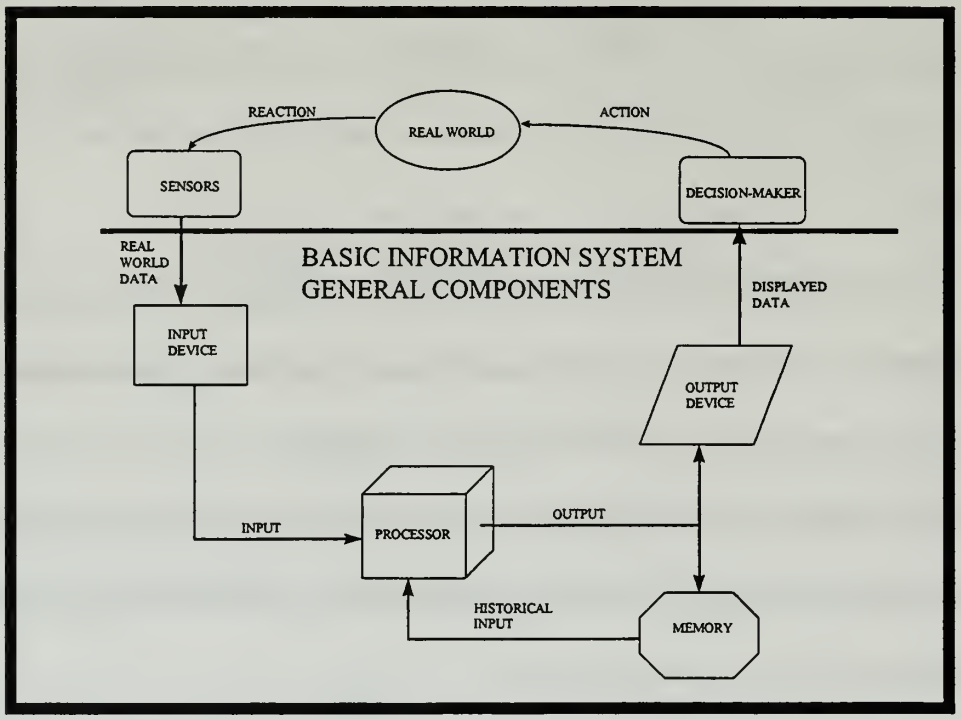

Figure 3.2 General Components of an Information System

Figure 3.3 builds upon the general components required by specifying the actual type of component desired for each category. The Cybernetic C2 system requires:

1. Input devices such as touch screens, scanners, keyboards, and microphones.

2. Processors such as natural language processors, logic processors, pattern recognition and visualization processors.

3. Output devices such as large screen displays, speakers, and printers.

4. Memory, or storage media, to hold various data bases and their data base management systems.

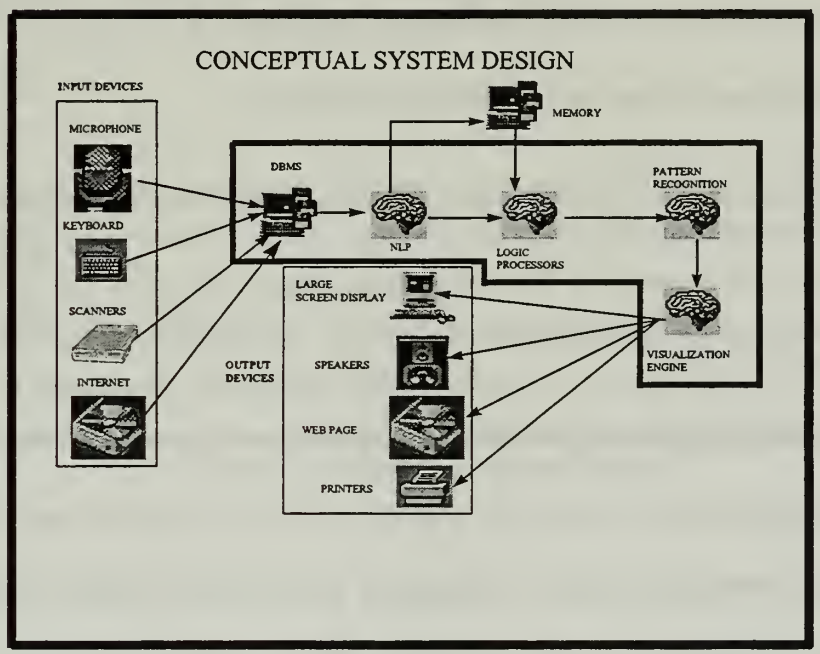

Figure 3.3 Conceptual System Design

C. ILLUSTRATION OF CONCEPT

A decision-maker is concerned with the events in Bosnia during the middle months of 1995 and wants to monitor the situation. The decision-maker chooses to use the Cybernetic C2 System to augment his skills and increase his understanding and control of the situation.

Data is continuously gathered on the events, actors and environmental state concerning Bosnia. This data constitutes all the variables acting in, and on, the monitored system (Bosnia). The data is fed to the C2 system directly from collection sensors, or

from the tasking of data specific intelligent agents that have searched the network for relevant data and returned it to the system, by other C4 systems providing ancillary data (GCCS), by message traffic (formatted intelligence assessments, etc.), and by any other type of open source data deemed relevant. These other open source data are characterized mainly as textual reports or articles (newspapers, magazines, etc.). The following text is an example of the type of data used as input to the system.

> *Reuters reports that Serbian forces attacked and destroyed an humanitarian aid convoy destined for Sarajevo last Friday. Serbian forces also intensified their attacks on the supposedly U.N. protected safe area of Zepa. As of Monday the Serbs were within one kilometer of the town. The Bosnian government, angry at the U.N.'s unwillingness to confront Serb aggression, threatened to revoke the U.N. peace-keeping mandate in their country.*

The collected data is transferred to digital format (if required) and stored in the main database. The stored data is then passed through the necessary processors for interpretation and deconfliction. These processors are natural language processors (NLP's) which interpret written text, extract the relevant data, and store the meaning of text in a database format.

The parsed data is then processed by other processors that rectify logic problems associated with temporal and spatial ambiguities. The NLP and these other logic processors are the heart of the system. They take the data and manipulate it to display it for the decision-maker. The output displays, shown and explained in detail later in Chapter V, are in the form of maps and timelines. Figure 3.4 is an example of one form of output, a timeline, based on the sample input text above.

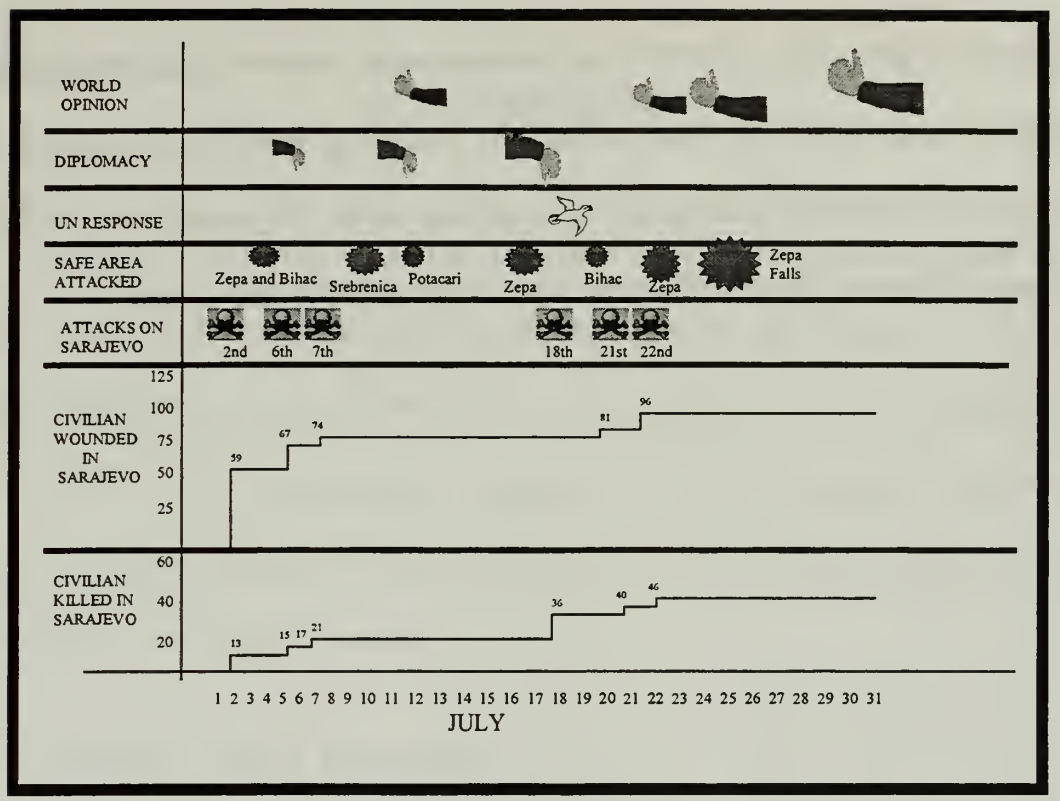

Figure 3.4 Sample Timeline Display

These displays, coupled with a processor that aids in pattern recognition and prediction, are the tools that aid the decision-maker in increasing understanding by assisting in identification of system variables that are going out of limits. With these displays a multitude of seemingly unconnected variables can be studied together. The displays, which help relate the variables together over time, will aid in the recognition of patterns, significant relationships, and bifurcation points. Recognition of these items help the decision-maker in recognizing the events that are forcing a system out of control.

With the information gleaned from the display a decision maker is better equipped to make decisions and act. The C2 system can also be used to construct Cybernetic

Regulatory Tables [Howland94][1] if the decision-maker wants to relate the disturbances versus resources variables. These tables aid in selecting appropriate courses of action based on the state of the system and in monitoring results of the application of different resources. The next chapter will describe the design of this system in detail.

[1] Cybernetic Regulatory Tables relate disturbance, resource, and essential (goal) variables together in a matrix format. The table is used by a decision-maker to assess variable relationships and choose courses of action based on those relationships.[Howland94]

IV. SYSTEM DESIGN

This chapter presents Data Flow Diagrams (DFD's) to show the design of the system. These DFD's detail the logical processes required by the Cybernetic C2 System. Physical components and processes are not of immediate concern when constructing logical DFD's. Some of the processes are assumed to exist or are treated as black boxes. The DFD's purpose is to detail the processes and flow of data between the processes that are required for the system to function.

A. CONTEXT LEVEL DIAGRAM

A review of Figure 4.1 shows the proposed system at its most basic level. This level details the system itself (labeled as the Cybernetic C2 Processing System) and the three main outside entities interacting with the system. Those entities are the customer, or decision-maker, all other C4 systems which may provide data to the system (labeled as the GCCS Mission Applications), and any open source data that may be used. This diagram also lists the different types of data which flow in and out of the system.

GCCS, and any other networked C4 system, provides general sensor data (electronic intelligence, signal intelligence, measurement and signal intelligence, photographic intelligence, etc.) collected by various means. Resource data (data pertaining to own force readiness, location, composition, etc.) is also provided by GCCS as is data on disturbances (enemy forces). The GCCS entity also provides data on the

decision-maker's, or national, goals and tolerances. This data is characterized by operation orders and mission goals and restrictions.

Like GCCS, the Customer entity provides data on goals, available resources, and limits imposed on the system. Outputs from the Cybernetic C2 system to the customer include chronology and geographic data of system variables (in the form of timeline and map displays). Regulatory Tables are both inputs and outputs to the system.

Open Source Intelligence, in the form of open source data, is input to the system from any applicable open source. The input is done directly as a result of an intelligent agent search, a data pull application, or user action.

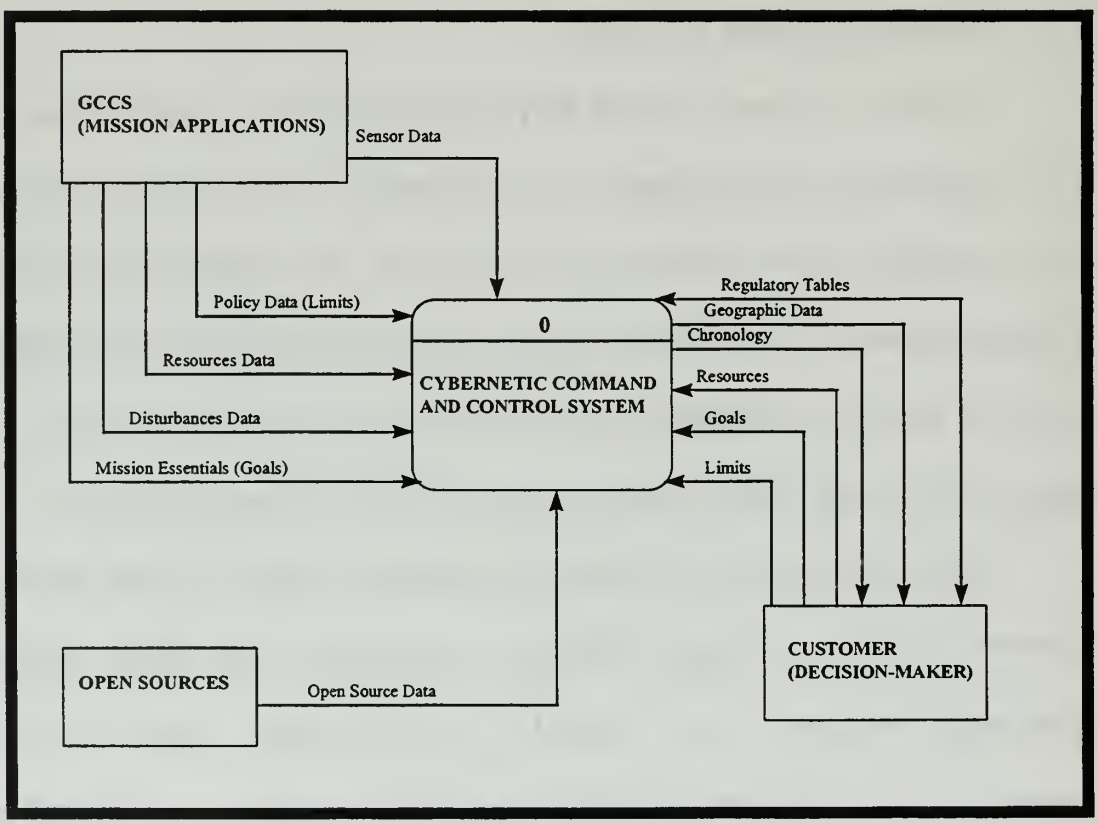

Figure 4.1 Context Level Diagram

B. LEVEL 0

Figure 4.2 is the exploded view of the context level diagram. It specifies the detailed processes and data flows that constitute the C2 system. The main processes are:

1. Gather Data
2. Store Data
3. Interpret Data
4. Store Interpreted Data
5. Disseminate and Display Information
6. Aid in Decision

These six processes, grouped together and interacting with the outside entities, are the details of Process 0 from the Context Level Diagram. In this figure the multiple inputs from the customer and GCCS entities are grouped and identified as Classified Data and Customer Data.

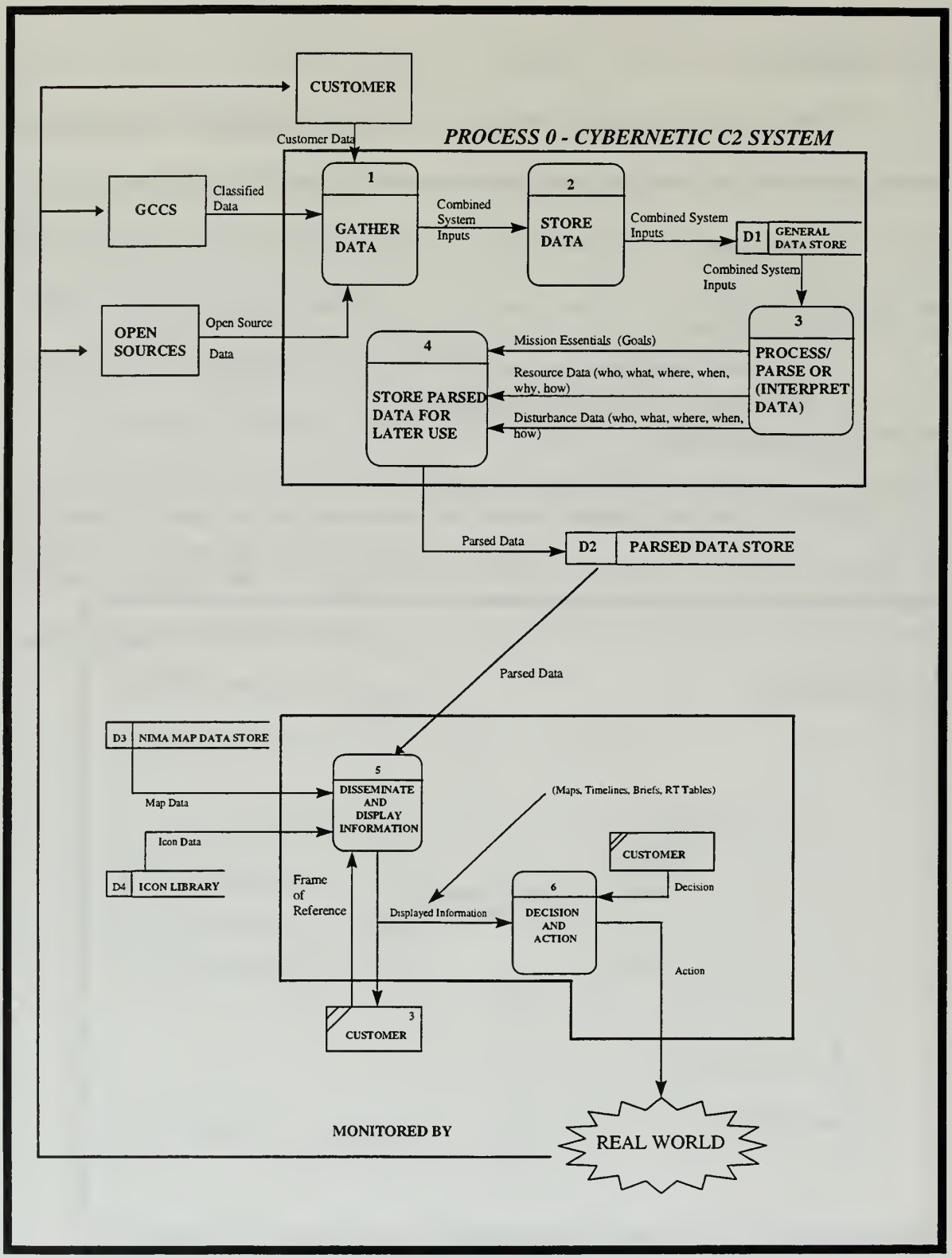

Figure 4.2 Level 0

Process 1, Gather Data, receives the inputs from the entities and passes it to Process 2, Store Data, as Combined System Inputs. Process 2 stores the Combined System Inputs in the General Data Store, D1. Process 3, Process/Parse Data, retrieves the Combined System Inputs form D1 and processes the data. Process 4, Store Parsed Data For Later Use, receives the parsed data and stores it in D2, the Parsed Data Store. The Parsed Data in D2 is synthesized data that Process 3 interpreted, synthesized, and separated into data on disturbances, resources, and goals. Process 5, Disseminate and Display Information, uses the Parsed Data stored in D2, customer defined reference frames, map data from the National Imagery and Mapping Agency (NIMA) stored in D3, and an Icon Library stored in D4 to construct and display the processed data. The data, now displayed as information, is used in Process 6, Decision and Action, to aid the decision-maker in choosing and implementing courses of action. Finally, the decision-maker monitors the real world which provides the feedback/monitoring mechanism for the decision-maker to re-orient himself.

C. PROCESS 1

Figure 4.3 is an explosion of the process Gather Data. It reveals the sub-processes involved in collecting raw data for further processing. Specifically the system can use any or all of these steps in gathering data. Once the data is gathered it is date and time stamped (to help reduce temporal ambiguity), combined, and stored.

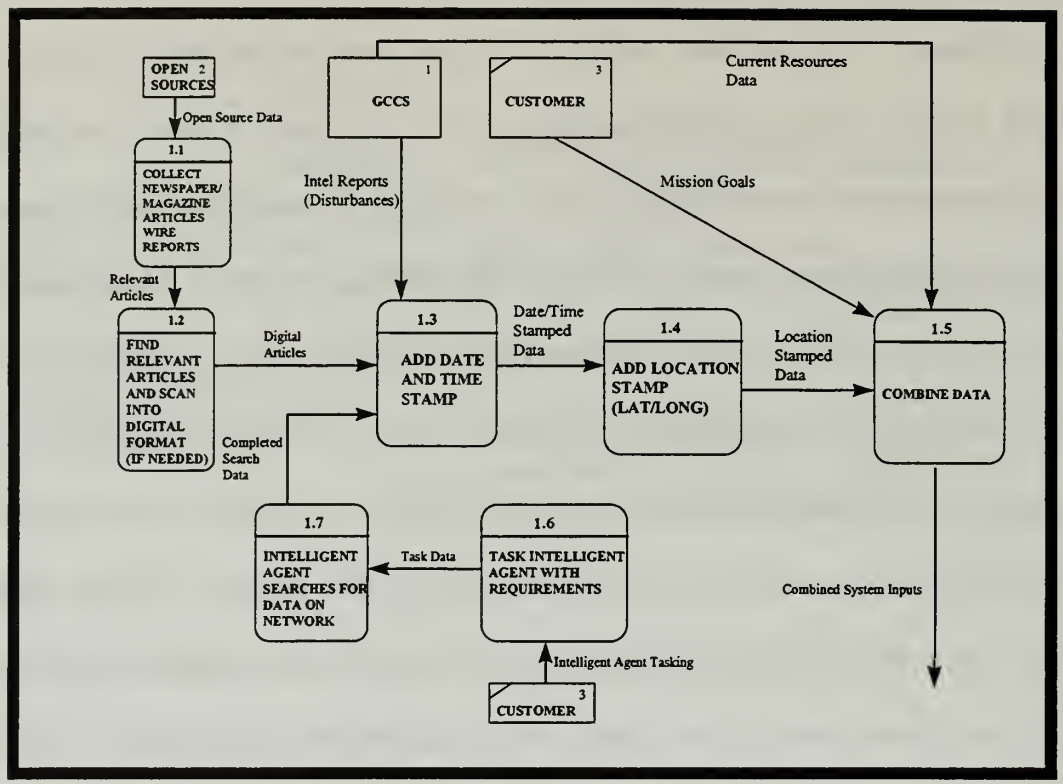

Figure 4.3 Process 1

Process 1.1, is the collection of open source data in the form of newspaper and magazine articles and feeds form news service wire reports. Relevant articles are separated from non-relevant articles and digitized, if necessary, during Process 1.2. The digital articles are passed to Process 1.3, as are inputs from GCCS in the form of intelligence reports, or disturbances, for addition of a date and time stamp. This date/time stamp is the actual date and time the data is input to the system. This will work for rapid intelligence collection systems that do not specify exact date and time of reported event occurrence. Process 1.6 is the tasking of intelligent agents to search networks for relevant data through Process 1.7. The agent returns data to Process 1.3 for a date/time stamp as well. The data flows from 1.3 into Process 1.4 which adds a general location stamp in the form of a latitude and longitude. This latitude and longitude reference is defined by the

user in initial system set-up. This general location stamp is provided as an initial frame of reference for the system. The user defines an area of interest for analysis and all incoming data is stamped with that reference. The main goal of this process is to provide a general location reference for data that may not specifically reference an exact location. This general reference can be used later for plotting purposes if needed. All of this data is passed to Process 1.5 where the data is combined with other data (customer defined goals and resource data from GCCS) input directly to Process 1.5 and stored in D1.

D. PROCESS 2 AND DATA STORE D1

Process 2, Store Data, accepts the Combined System Inputs and stores the data in D1. The data is stored here to mitigate the risk of possible data loss or corruption in downstream processes as well as to allow multiple processes to access and use the data.

The data store, D1, is a large relational database with its associated Data Base Management System (DBMS). The data is stored as tables with relationships among rows in the tables visible with the data. The Combined System Inputs automatically cataloged here are available for immediate retrieval and use. The flexibility of relational databases allows users to create custom queries of data. This flexibility makes D1 valuable to other users and does not restrict it functionality to this system alone. D1 is a value added feature of the system, accessible by other systems if desired.

E. PROCESS 3

Figure 4.4 details the sub-processes of parsing data. Data from the General Data Store (D1), is parsed by the Natural Language Processor for categorization and for

combination with other relevant data. This is accomplished in Process 3.1, 3.2, and 3.3. The combined texts are synthesized to remove duplication in Process 3.4. The synthesized data is processed to separate it into appropriate categories (disturbances, resources, and goals) during Process 3.5 and stored as Parsed Data in Data Store D2. A more detailed explanation of this process is covered in Chapter V.

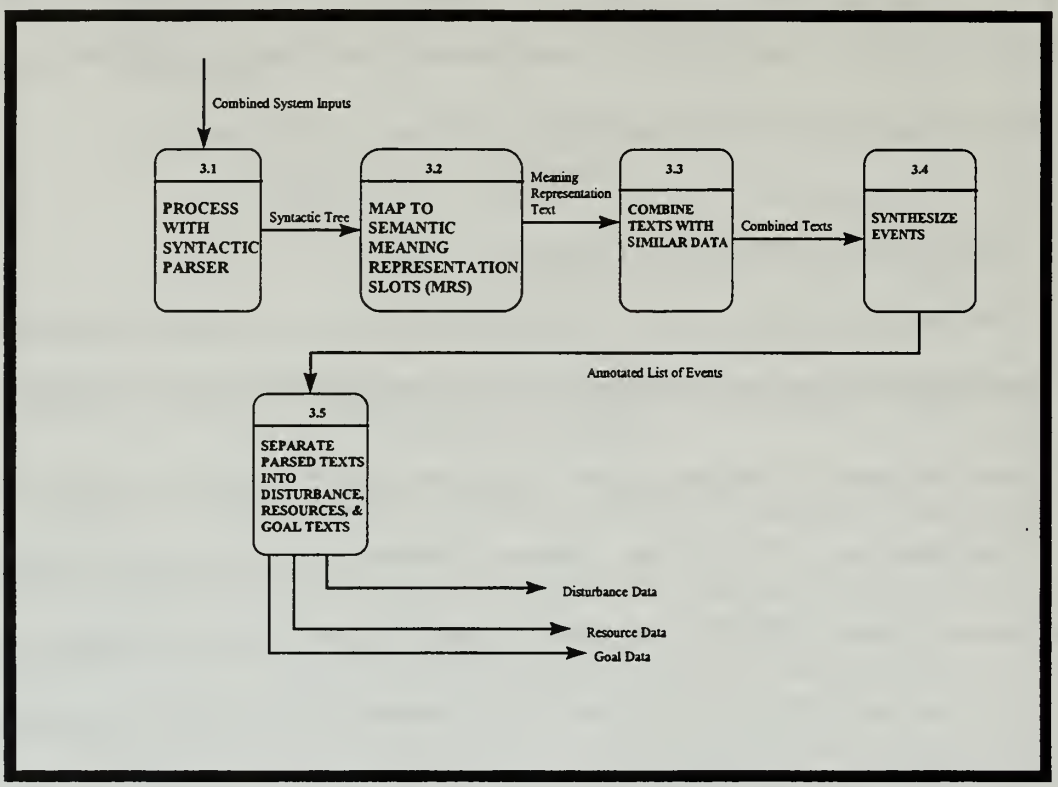

Figure 4.4 Process 3

F. PROCESS 4 AND DATA STORE D2

Synthesized data, in the form of disturbances, resources, and goals, is stored in D2 through Process 4. Process 5, Disseminate and Display Information, retrieves the Parsed Data from D2 for manipulation and display.

D2 is in reality a distributed relational database and associated DBMS. The distributed database consists of individual databases for disturbance, resource, and goal

data. The distributed database maintains data integrity while offering flexible data access. Disturbances, resources, and goals are stored separately yet appear to be together when processes query data. All of the input data is processed and synthesized by the time it reaches this data store.

G. PROCESS 5

Figure 4.5 diagrams the general process of disseminating and displaying the information. The first step is to retrieve the parsed data from D2. The data is separated and used to aid in generating maps, timelines, and reports.

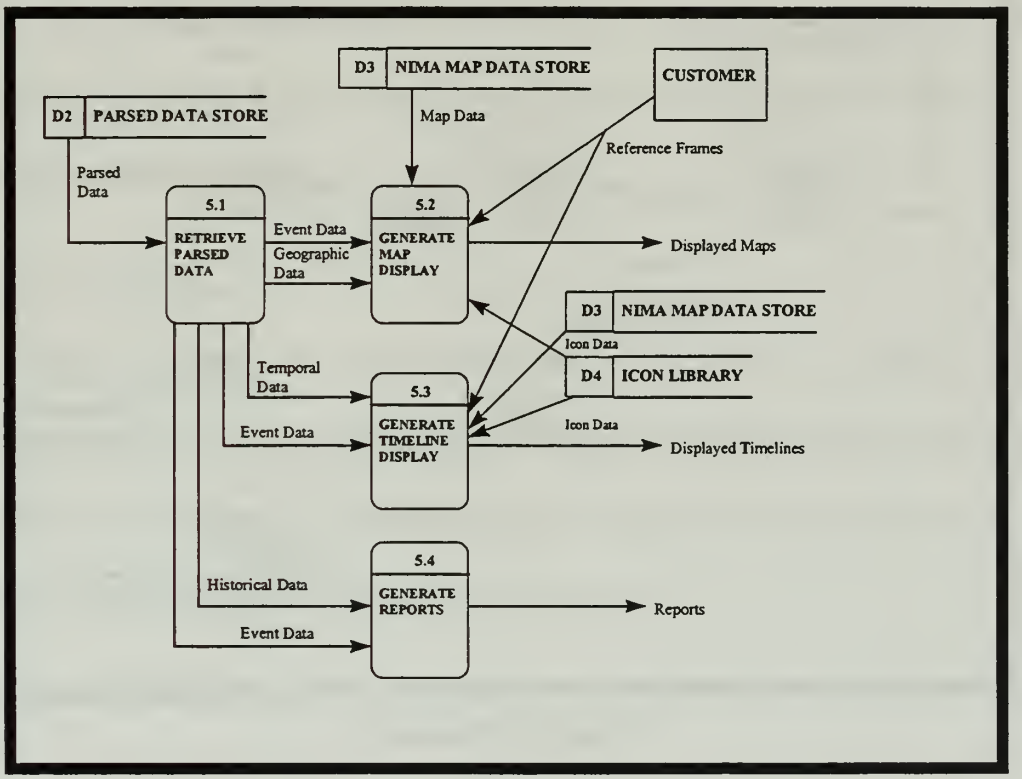

Figure 4.5 Process 5

Data on specific events and necessary amplifying data (temporal, geographic, and historical) are provided to Processes 5.2, 5.3, and 5.4. Processes 5.2 and 5.3, Generate

Map and Timeline Displays, also receives Map Data input from D3, Icon Data from D4, and Reference Data from the Customer.

H. PROCESS 5.2

Figure 4.6 illustrates the processes for using the data for map displays. The data is searched for some reference to a geographic location and unit identification. Once these are found the geographic data is converted to a Latitude and Longitude for plotting while a symbol is assigned to represent the unit's identification.

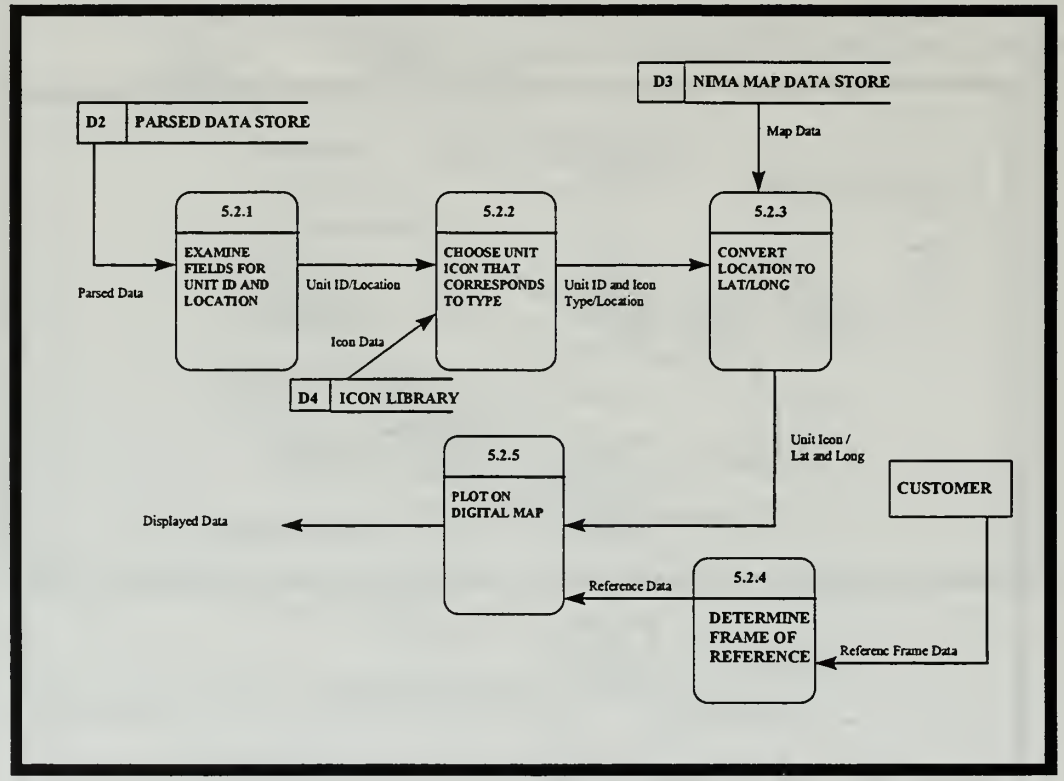

Figure 4.6 Process 5.2

Process 5.2.1 retrieves Parsed Data from D2 and examines data fields for reference to unit, or actor, identification and location. When this data is found Process 5.2.2 assigns an appropriate icon, stored in D4, to represent the unit when plotted on a

map. Process 5.2.3 performs a similar function for the conversion of the location reference contained in the data to a specific position for plotting on the map. This conversion is done by a system of cross referencing a series of NIMA provided data tables which list place names with corresponding latitude/longitude data. Proper names of places will cross to a specific latitude/longitude which is then attached to the data. Map Data from D3, NIMA Map Data Store, is also used to create the appropriate digital map. The customer then provides a frame of reference in Process 5.2.4 to enable the system to scope the area of interest and more accurately plot the data on the map provided by D3. This reference data also guides the system in displaying amplifying narratives. Process 5.2.5 integrates the Reference Data with the Plot Data and plots the icon on a map at the appropriate location.

I. PROCESS 5.3

Figure 4.7 details the sub-processes that are required for timeline creation. Retrieved data from D2 is examined for event and unit identification and reference to a time frame. Once these are found a symbol is assigned to the event and the time reference is used to accurately plot the event occurrence.

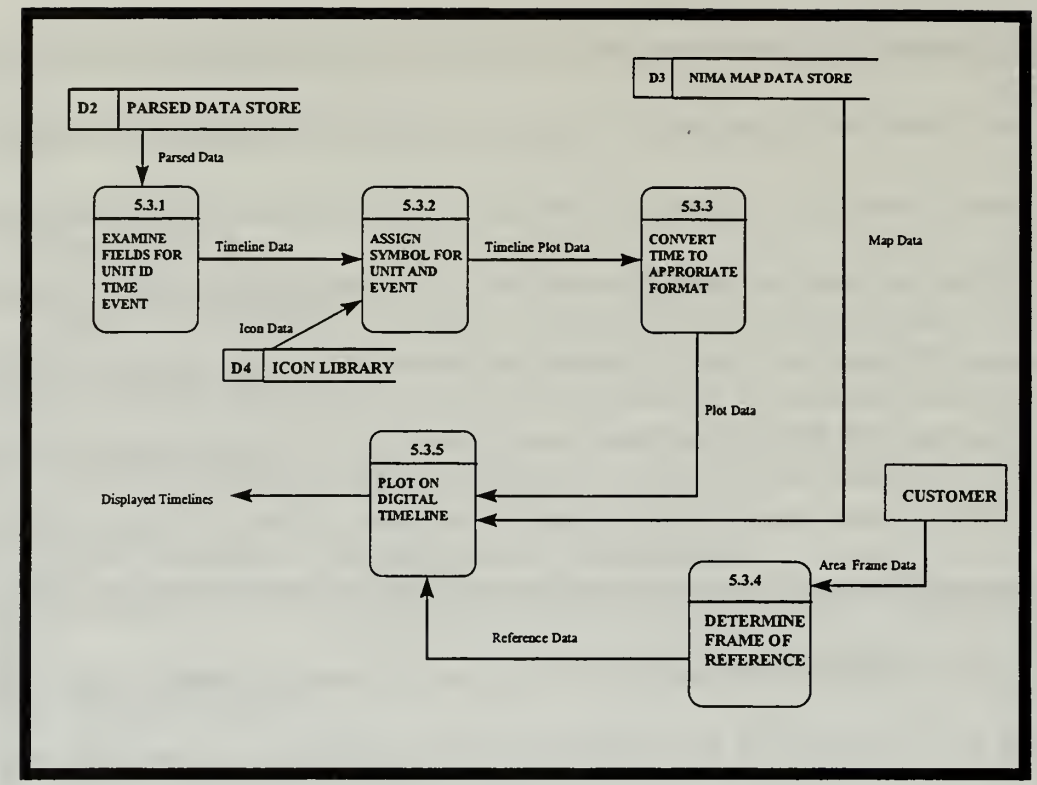

Figure 4.7 Process 5.3

Processes 5.3.1, 5.3.2, 5.3.3, 5.3.4, and 5.3.5 are similar to the sub-processes occurring in Process 5.2. These processes essentially perform the same functions as Process 5.2, but they perform it referenced to time vice geography. The event, or actor, must be identified (Process 5.3.1) and a symbol assigned from D4, Icon Library (Process 5.3.2). Process 5.3.3 converts the time reference to the appropriate format for plotting on a timeline (Process 5.3.5) according to the customer's frame of reference (Process 5.3.4) and data from D3.

Process 5.3.3 must deal with complexities associated with assignment of event occurrence. These complexities include the deconfliction of events that occur

continuously vice instantaneously (i.e. sustained combat campaign vice a single, isolated attack) or are described in general terms like past or presently.

Both Processes 5.2, Generate Map Display, and 5.3, Generate Timeline Display, must resolve complex issues associated with spatial and temporal vagueness. There often exists a discontinuity between a situation described in natural language text and internal system representation of that situation. The greatest challenge to these processes is the transformation of natural language descriptions into proper internal system representations. The inclusion of a frame of reference, provided by the user, will help resolve some ambiguity. Other solutions include defaulting to a system designated time (which I offer as one option in Process 1.6, Combine Data and Add Date Stamp) or attempting to pictorially represent the vagueness, or discontinuity, of the text in the visual display.

J. PROCESS 5.4

Figure 4.8 details the sub-processes that allow a user to request data. First a user makes a specific query, Process 5.4.1, for data. The Query Data is used by the system to locate and extract the data requested from D2 in Process 5.4.2. Process 5.4.3 formats the retrieved data to fill the user's request, and outputs the data in the appropriate report format. These formats may be written summaries, narrative texts, pre-formatted messages, etc.

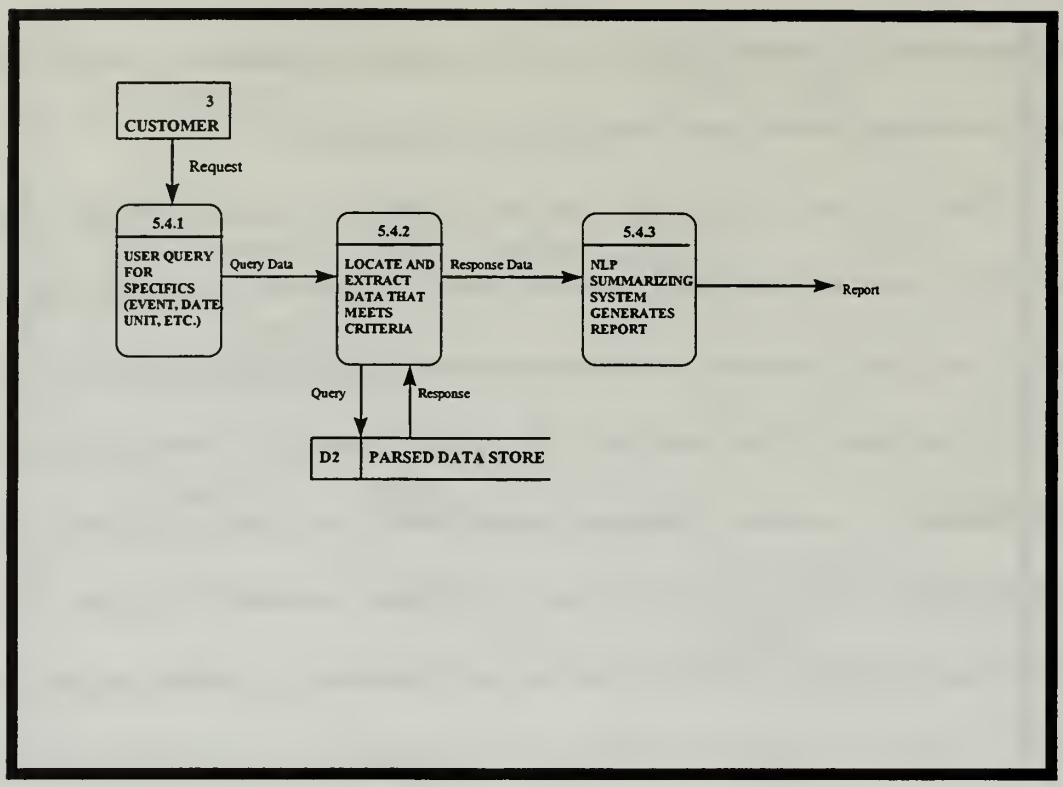

Figure 4.8 Process 5.4

K. PROCESS 6

Figure 4.9 illustrates the processes involved in making a decision, choosing a course of action, and implementing that decision by executing the action. The various output displays of the system help the decision-maker, or the system itself, formulate the desired goal state of the observed system.

Process 6.1 represents the goal formulation process with its output labeled Goal Data. Processes 6.2 and 6.3 encompass the identification of disturbances affecting the observed system and resources available to a decision-maker. The process of identifying the relationships between variables operating in the observed system is done in Process 6.4. Construction of a Regulatory Table is not the only manner in which the variable

relationship must be represented, but is offered here simply as an example. The final process, 6.5, is the decision by the customer on some course of action (or non-action).

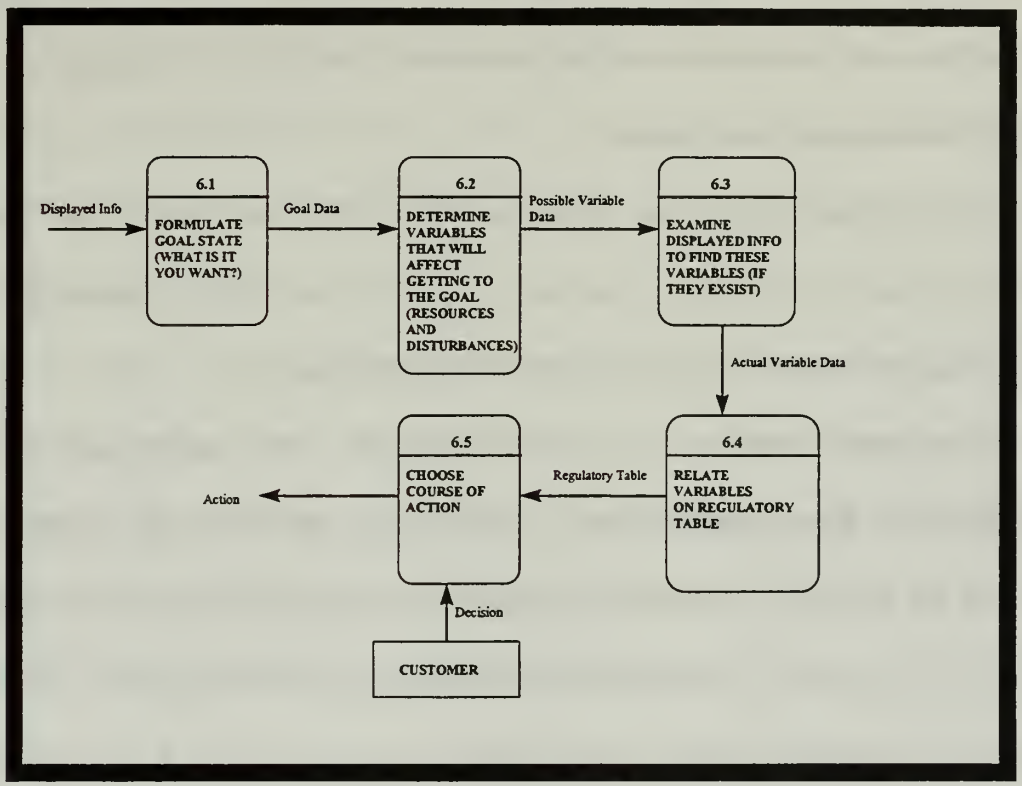

Figure 4.9 Process 6

L. OODA LOOP

After action is taken, decision-makers must complete the processes involved in observing reactions in the system. This is the feedback/monitoring portion and it is essential. This process of observing the system to determine if it is going back into limits closes the loop by returning the decision-maker to the observation stage of the OODA Loop. In effect Processes 1 through 5, detailed earlier in this chapter, are analogous to the Observe and Orient stages of the OODA Loop while Process 6 corresponds to the Decide and Act stages.

M. PHYSICAL SYSTEM DESIGN

Chapter III contained the conceptual system design as illustrated in Figure 3.2. Many of the actual components to create the system currently exist in various forms and levels of technological development.

The necessary input and output devices exist at the ready-to-use level of development and are available as Commercial Off The Shelf (COTS) technology. They can be integrated and used 'as is' with little, or no, modification.

The heart of the system are the processors. The technological level of development for these processors vary. Rudimentary natural language processors do exist and can be used. Systems like PARALLEL [Chung94] and the Core Language Engine (CLE) [Alshawi *et al* 88] are two examples of existing systems. Efforts to increase NLP capabilities are of great interest to many in the AI field including the Defense Advanced Research Projects Agency (DARPA) which sponsored several Message Understanding Conferences (MUC) [Sundheim91].

Pattern recognition and machine learning processors and tools also currently exist. PANS [Abramson94], SCORPIUS [Simpson88], and MATIS [Canamero96] are current operational systems that use some pattern recognition technology.

AI logic processors also exist at low levels of complexity. These processors are concerned with resolving ambiguities, temporal and spatial, as well as any general logically conflicting activity or problem. Some current systems use prepositional and

predicate logic techniques or knowledge representation schemes to aid in solving logic problems. [Bhargava96]

Visualization tools that are adequate for this system also exist. Research is expanding and improving this area as well. The conceptual design for a multimedia interaction manager, known as CICERO, [Arens97] summarizes the direction in which this technology is moving.

At current levels of technology some components exist to build, albeit at a rudimentary working level, this system today. The areas requiring the most improvement, the processors, are constantly being improved and modified. The possibility to realize this system, technologically, continues to increase and this thesis proposes how to build such a system from these components.

V. SYSTEM IMPLEMENTATION

I have discussed general C4 systems and briefly outlined their capabilities and functions as well as what is desirable (and needed) in future C4 systems. I also mentioned several advances in AI technology and designed a conceptual C4 system that exploits these AI technologies and cybernetic techniques. In this chapter I present a situation for analysis using the conceptual system. Since the system is just that, conceptual, I performed many of the functions that would be done automatically, and with much greater speed and accuracy, by the system (data gathering, processing, displaying, etc.) and then analyzed the results as they would be presented for a decision maker.

Unlike a computer system using AI, I was not hindered by an inability to use an accumulated wealth of commonsense knowledge. This system would require a knowledge base that allows it to perform inferences and build upon a set of commonsense knowledge as I did. Such a knowledge base would have to contain background information, business rules, common sense, etc. I applied my knowledge in these areas as I simulated functions of the system. For example, I knew the geo-political history of Yugoslavia, theories and events of warfare throughout history, historical data on UN involvement in strife-torn countries, etc. Possessing this commonsense knowledge made it easy for me to draw inferences and simulate system operation.[Davis90]

The situation and time frame chosen for analysis is the conflict in Bosnia beginning in early July 1995. I chose this situation to test the conceptual system for the following reasons:

1. It was a good example of a CAS.
2. A large amount of data was available on the situation.
3. It concerned military and governmental agencies and decision-makers.

The following section summarizes the events during the time frame chosen for analysis.

A. PROBLEM BACKGROUND

A brief background of major events that occurred in Bosnia is presented here. This background, beginning with the week of 2 July 1995, will give the reader a general feeling for the situation that existed in Bosnia. These summaries are a result of extensive research and data synthesis by myself. Following this overview will be an analysis of the events using the cybernetic techniques and the conceptual system presented earlier.

WEEKLY SUMMARIES:

WEEK OF 2 JULY 1995

Confirmed deaths from starvation in Bihac, a UN safe area under siege by Serb forces. Food shortages reported as critical in Sarajevo, which also came under heavy attack by Serb forces. Civilians suffered heavy casualties. Zepa, another UN safe area, came under heavy attack by Serb forces. UN's only response to the violence was to send a letter demanding a halt. Bosnian government cuts ties with the UN's top civilian official due to his inaction and unwillingness to confront Serbian aggression.

WEEK OF 9 JULY 1995

UN safe area of Srebrenica falls to Serbs. 20,000 refugees flee and seek protection at nearby UN compound in Potacari. Serbs then overrun Potacari and remove all males between the ages of 16 and 55 from the refugee camp. UN offers no resistance. Bosnian government calls on U.S. Senate to lift arms embargo against Bosnia. Senator Dole promises a call for a vote on the issue.

WEEK OF 16 JULY 1995

Civilians driven from Srebrenica report horrifying accounts of rape and executions by Serb forces. UN reports that over 19,000 people are unaccounted for from Srebrenica. Attacks on Zepa intensify. NATO warplanes circle over the city but take no action. UN peace keepers disable or hide their weapons to prevent the defenders in Zepa from using them to stave off the Serb attack. Bosnian government threatens to terminate UN mandate if the UN will not confront Serb aggression. Sarajevo attacks continue daily.

WEEK OF 23 JULY 1995

More bad news from Srebrenica. Reports of death march of refugees' reveals that 11,000 of 15,000 died. Numerous Jewish groups and South Africa's President Mandela call for decisive action to stop carnage in Bosnia. Serbs from neighboring Croatia aid Bosnian Serbs in assault of Bihac. Daily attacks on Sarajevo continue. Sixteen-nation conference in London concludes with pledge of a "substantial and decisive" response if Serbs attack the UN safe area of Gorazde in Eastern Bosnia. Bosnian Army makes small gains against Serbs in North Central Bosnia near Tuzla. Zepa finally falls to Serbs, UN has no response.

WEEK OF 30 JULY 1995

Reports that Serbs used "incapacitating gas" in final hours of Zepa assault to end resistance surface. Thousands of civilians flee to hills and caves with 3,000 unaccounted for according to UN. Chief UN investigator for human rights abuse resigns in protest of the UN's inaction. NATO threatens air strikes against Serbs if Gorazde attacked. U.S.

Congress passes bill to end arms embargo. Coalition of 27 religious, human rights and humanitarian groups, calls for multilateral military action to stop Serb atrocities. Protests and rallies criticizing UN inaction and world policy take place in Italy, India, Iran, South Africa, Sudan, and Turkey with hundreds of thousands involved. National leaders in Bangladesh, Malaysia, Philippines, and Indonesia call for action.

WEEK OF 13 AUGUST 1995

Bosnian forces attack Serbs west of Sarajevo. President Clinton vetoes bill to end arms embargo. Serb refugees flee Krajina, Croatia after Croatian forces overrun town. U.S. presents UN with evidence of mass graves in Srebrenica. Tuzla under attack from Serbs. Serbs prepare for attack by Croatian forces in Southeastern Bosnia. U.S. government openly supports peace plan that divides Bosnia.

WEEK OF 20 AUGUST 1995

Attacks on Sarajevo increase. UN pulls troops out of Gorazde. Refugee camps in Tuzla attacked. Serbia forcefully expels Bosnian Serbs back to fight in Bosnia.

WEEK OF 27 AUGUST 1995

37 Civilians killed in downtown marketplace in Sarajevo by Serbian artillery. U.S. threatens Serbs with NATO air strikes if they refuse to accept peace plan. Proof of genocide surfaces in final report by UN human rights investigator. NATO launches massive air strikes against Serb forces near Sarajevo, Tuzla, Gorazde, and Mostar. UN Rapid Reaction force attacks Serb artillery surrounding Sarajevo. Serbs respond with more attacks on Sarajevo. Russia criticizes air strikes but also condemns Serbs' attack on Sarajevo. Senator Dole criticizes President Clinton saying "one day of military action does not make up for three years of passivity and failure."

B. SYSTEM INPUTS (DATA GATHERING)

To simulate the inputs to the system I gathered data on Bosnia from as many open sources available. These included news wire reports (Reuters, AP, UPI, etc.), newspaper articles (Washington Post, New York Times, Boston Globe, etc.), and electronic archives

on the Internet (CNN, DOD Boslink, This Week in Bosnia, etc.). I used this data for the background outlined above. The data so gathered simulates the natural data the system would store in its first form (unprocessed or raw from). The data has simply been gathered from many different sources and stored. To simulate the further operation of the system I broke down the data by daily events as listed below.

DAILY LISTING OF RAW DATA:

SUNDAY 2 JULY 1995

-Serbs fire on UN aid convoy bound for Sarajevo
-Serbs shell Sarajevo, 13 civilian dead, 59 wounded

MONDAY 3 JULY 1995

-Serbs fire on another UN aid convoy bound for Sarajevo
-Bosnian Army makes limited gains in infantry attacks against Serb forces north of Sarajevo

TUESDAY 4 JULY 1995

-Town of Zepa, UN safe area, attacked by Serbs
-Town of Bihac, UN safe area, attacked by Serbs

WEDNESDAY 5 JULY 1995

-2 starvation deaths in Bihac
-Food shortage critical in Sarajevo
-Bosnian government threatens to sever ties with UN if it does not confront Serb aggression

THUSDAY 6 JULY 1995

-Serbs blamed for 2 civilian killed and 8 wounded in Sarajevo attacks

FRIDAY 7 JULY 1995

--Serbs blamed for 4 civilian killed and 7 wounded in Sarajevo attacks

TUESDAY 11 JULY 1995

-Town of Srebrenica, UN safe area, falls to Serbs
-20,000 refugees flee Srebrenica, seek protection from UN element in nearby Potacari
-Bosnian government calls for head of UN mission in Bosnia to resign

WEDNESDAY 12JULY 1995

-Refugees at Potacari overrun by Serbs
-Refugee men between ages of 18-55 removed by Serbs
-Town of Zepa attacked again
-Senator Dole promises Bosnian government that Senate will vote on bill to end arms embargo

FRIDAY 14 JULY 1995

-Serbs destroy humanitarian aid convoy destined for Sarajevo

MONDAY 17 JULY 1995

-Attacks on Zepa intensify, Serbs one kilometer from town
-Bosnian government threatens to end UN peacekeeping mandate if UN continues to avoid confront Serbs

TUESDAY 18 JULY 1995

-Reports of rape and executions of prisoners and refugees from Srebrenica
-French call for international reinforcement and protection for town of Gorazde
-Reported that 10 to 15 civilians killed daily in Sarajevo over past several days

THURSDAY 20 JULY 1995

-Serbs from Croatia aid Bosnian Serbs in new attacks on Bihac

FRIDAY 21 JULY 1995

-Rocket attack on Sarajevo kills 4, wounds 7
-16 Nation conference held in London

SATURDAY 22 JULY 1995

-6 killed, 35 wounded in Sarajevo
-2 UN peace keepers killed while escorting convoy
-Islamic Conference calls for lifting of illegal arms embargo on Bosnia

SUNDAY 23 JULY 1995

-Zepa attacks intensify, town ready to fall

MONDAY 24 JULY 1995

-Numerous humanitarian groups worldwide call for action to stop war in Bosnia
-Starvation becoming serious problem in Bihac
-Jordan raises $6 million in humanitarian aid for Bosnia
-Jordan also says it will send troops to Bosnia if needed

TUESDAY 25 JULY 1995

-Zepa falls to Serb forces

FRIDAY 28 JULY 1995

-Croatian troops cross border into Bosnia

SUNDAY 30 JULY 1995

-Worldwide protests begin calling for action to halt Serb aggression

MONDAY 31 JULY 1995

-27 religious and human rights groups protest international community's inaction in Bosnia

TUESDAY 1 AUGUST 1995

-Worldwide protests and rallies continue
-U.S. Congress passes bill to end arms embargo

WEDNESDAY 2 AUGUST 1995

-Croatian forces attack town of Drvar in western Bosnia

THURSDAY 3 AUGUST 1995

-Croatians capture two Serb held towns in southern Bosnia (Glamoc and Grahovo)

FRIDAY 4 AUGUST 1995

-Croatian forces capture Serb held town of Knin
-Serb refugees flee to Bosnia

TUESDAY 8 AUGUST 1995

-Croatians capture Serb held town of Krajina
-Serb refugees flee to Bosnia

WEDNESDAY 9 AUGUST 1995

-Serb refugees flee to Bosnia from Krajina

THURSDAY 10 AUGUST 1995

-Serbs open road to Bihac, allow travel into city

SATURDAY 12 AUGUST 1995

-Croatians prepare to attack in south Bosnia and town of Trebinje

SUNDAY 13 AUGUST 1995

-Town of Tuzla shelled by Serb forces

TUESDAY 15 AUGUST 1995

-Bosnian forces attack Serbs north of Sarajevo, drive towards town of Donj Vakuf
-Croatians block deployment of UN Rapid Reaction Force

SUNDAY 20 AUGUST 1995

-Serbia forces Bosnia Serb refugees to return to Bosnia and fight

TUESDAY 22 AUGUST 1995

-6 killed, 38 wounded in Sarajevo
-Serbs attack UN peace keeping force
-Refugees from Tuzla attacked by Serbs

WEDNESDAY 23 AUGUST 1995

-UN pulls peace keepers out of Gorazde
-UN Committee for Elimination of Racial Discrimination calls for UN Security Council to give Bosnia means to protect itself from Serbs

MONDAY 28 AUGUST 1995

-33 civilians killed in Sarajevo marketplace after Serb attack
-Proof of genocide perpetrated by Serb forces presented to UN

These daily summaries help demonstrate the functions that the NLP would need to handle. The NLP would read and process the data input into the system in a fraction of the time that it took me to perform the same function. The data is now in its second form, parsed and ready for further processing.

C. PROCESS

In this section I present three example sentences, taken from the actual texts in the previous section, to conceptually illustrate system processes described in the DFD's in Chapter IV.

The following texts represent input data to the system:

1. *The Serbian rocket attack killed 4 civilians on 21 July near the downtown market in Sarajevo.*
2. *The Bosnian government threatened to sever all ties with the UN if the UN does not begin to confront Serb aggression.*
3. *Reports indicate that Croatian troops crossed the border and attacked Serbian units located in Southwestern Bosnia on 28 July.*

The text for sentence one was collected from a Reuters web page on the internet. For illustrative purposes the data was retrieved from the web page by an intelligent agent that was tasked to find this, and other similar, data (Processes 1.6 and 1.7). The collected text is time and date stamped with the exact time it is input to the system (Processes 1.3 and 1.4). The date/time stamp assigned by the system for this example is Monday 24 July, 1995 / 0130 Greenwich Mean Time(GMT). The data is also stamped with general location data pre-defined by the user. In this case the area of interest is Bosnia so the latitude and longitude for the country is attached.

The second sentence is from a magazine article. The article is digitized by a scanner (Process 1.2) and input directly to the system. The date and time that it is input is attached to the article (Process 1.3) as well as location data for area of interest (Process

1.4). For this sentence date/time of data entry was Wednesday 5 July, 1995 / 1205 GMT. Location stamp is Bosnia area of interest.

The final sentence is simulated input from GCCS. It is input directly and date/time stamped (Process 1.3) with Friday 28 July, 1995 / 2358 GMT. Area of interest is again Bosnia so the appropriate location data is attached.

All of the input data is combined (Process 1.5) and stored in the system's first data store D1 (Process 2) and later retrieved by the NLP for processing (Process 3). D1 is a relational database that stores data based on date stamping. This supports system queries for processing at a later time for events that were input on specific dates.

I will use the first sample sentence to conceptually illustrate the process of parsing and assigning semantic meaning to the textual data. This illustration is representative of how all text would be processed.

The first thing the NLP does is parse the sentence (Process 3.1). Parsing is a grammatical and syntactical structure identification of the individual words in the text. The parsing output for the example sentence above is presented below. The output, displayed on the following page, is presented in a form that simulates output from the ROBIE Natural Language Processor.

```
S-1     [s, major, decl]
        NP-1    [ns, np, n3p, def]
                DET []          THE [ns, npl, n3p, det, def]
                ADJ[]           SERBIAN [ns, n3p, adj]
                ADJ[]           ROCKET [ns, n3p, adj]
                NOUN[]          ATTACK [ns, noun, n3p]
        AUX-1 [past, aux, vspl
        VP-1 [vp, tnsless, past, vspl]
                VERB[]          KILLED [past, en, verb, vspl]
                NP-2 [npl, np, n3p]
                        QP-1 [npl, qp]
                                QUANT []        4 [npl, ngstart, quant]
                        NOUN []         CIVILIANS [npl, noun, n3p]
                PP-1 [pp]
                        PREP []         ON [prep, time_abs, location]
                 NP-3 [ns, np, n3p]
                        NOUN []         21 JULY [ns, noun, n3p, time2]
                PP-2 [pp]
                        PREP []         NEAR [prep, location]
                  NP-4 [ns, np, n3p, def]
                        DET[]           THE [ns, npl, n3p, det, def]
                        ADJ[]           DOWNTOWN [ns, n3p, adj]
                        NOUN[]          MARKET [ns, noun, n3p]
                 PP-3 [pp]
                        PREP[]          IN [prep, location]
                    NP-5 [ns, np, n3p, def]
                        NOUN []         SARAJEVO [ns, noun, n3p]
```

The simulated output from a parser, shown above, depicts a general representation of a linguistic processor that analyzes input text, sentence by sentence. The goal of a parser is to reveal the syntactical structure of a sentence. The structure is reminiscent of sentence diagram trees from grade school grammar class. The parser identifies the syntax of words (how words are used) and the relationships between words.

In the example above the parser identified the noun phrases (labeled as NP-1 through NP-5), verb phrases (labeled VP-1), and prepositional phrases (labeled PP-1

through PP-3). It also identified the relationships of words within these phrase (i.e. adjectives, quantities, prepositions, nouns, and verbs).

Now that the sentence is parsed the NLP can assign the individual words to Meaning Representation Slots (MRS) via a Slot Mapper [Ludlow88]. The Slot Mapper takes the parsed sentence, determines a semantic meaning and assigns them to an appropriate MRS (Process 3.2). Examples of MRS types include, but are not limited to:

1. Actor
2. Main Verb
3. Source
4. Location
5. Object
6. Time

The parsed example sentence would fill MRS as follows:

actor	qty	THE [ns, npl, n3p, det, def]
actor	adj	[SERBIAN] [ns, n3p, adj]
actor	adj	[ROCKET] [ns, n3p, adj]
actor	main	ATTACK [ns, noun, n3p]
verb	main_verb	KILLED [past, en, verb, vspl]
object	qty	4 [npl, ngstart, quant]
object	main	CIVILIANS [npl, noun, n3p]
time	time_abs	[on 21 july] [time_abs, ns, noun, n3p, time2]
location	main	[near the downtown market] [loctation-pp]
location	main	[in sarajevo] [location-pp]

The assignment of parsed words to meaning representation slots reveals the semantic structure of a sentence (what the words mean or represent). In this example it is

clear from the MRS which words represent actors acting on certain objects with certain results at certain times and in certain locations.

The processed data is now in the form of Meaning Representation Text. This text is combined with similar processed data (Process 3.3). Combination of duplicate text or text that reference the same things eliminates redundant data (data glut). It also puts like text together, it synthesizes data and associates similar data (Process 3.4). Once data is synthesized it is separated into broad categories relating to disturbances, resources, and goals (Process 3.5). This is an even higher level of data synthesis. Similar data describing the same specific event is combined in Process 3.4 and then combined with other data fitting a general description of the text in Process 3.5 (attacks by enemies are grouped together, diplomatic efforts are grouped together, etc.)

The synthesized MRS are then stored in the system's second data store, D2 (Process 4), as disturbances, resources, and goals until the data is needed. When the data is required, either for generating maps (Process 5.2), timelines (Process 5.3), or reports (Process 5.4), it is retrieved (Process 5.1) from the distributed database. The system uses the now parsed and slotted example sentence for generation of a timeline and map display to further illustrate the processes involved.

The event that occurred is found in the ***Actor, Object, Verbs*** slots. In sample sentence one, the ***Actor, Adjective*** slots are filled with ***Attack, Serbian, Rocket*** so the system matches that description to the pre-designated icon (Processes 5.3.1 and 5.3.2). The ***Object, Verb*** was ***4 Civilians Killed***. This event is matched to its appropriate icon, too (Processes 5.3.1 and 5.3.2). These functions can be quite complicated, requiring

domain or real-world knowledge, but this illustrates the process. The next two processes, involving time and location, are also difficult.

The time that the event occurred is identified as ***21 July*** (Process 5.3.1). This specific time poses no problem for plotting. If, however, the time was identified simply as ***Friday***, there would be difficulties. This illustrates one of many ambiguities that must be resolved with the logic processors before the data can be displayed by the visualization engine.

One manner of handling this specific problem is a quick reference to the date stamp assigned to all input data. If the word ***Friday*** had the modifier ***Last*** and the system date stamp was ***Monday, 24 July 1995*** then the logic processors would deduce that the ***Friday*** reference was to ***Friday, 21 July 1995***. Other options include defaulting to the date/time stamp as date/time of event occurrence (with an appropriate note that it is a system assigned estimate and not actual date/time) (Process 5.3.3).

The problem with pinpointing the location for plotting is also difficult for this example. ***Sarajevo*** is a name of a city that the system recognizes, but ***Downtown Market*** is vague. Where exactly in Sarajevo was the market located? If the location was too vague, then the process of a user providing a frame of reference to limit the area of interest (Process 5.3.4), combined with cross referenced tables from D3, simplifies the resolution of most vagueness or ambiguity. [2]

---

[2] The reader is encouraged to reference D.A. Pospelov's work, cited in the List of References, for a more comprehensive discussion of pseudo-physical logics and associated problems of accurate representation.

Sample sentence two is used to detail operation of processes involved in generating a summary report requested by a decision-maker. A query for a summary report on reactions of Bosnian government officials in July is requested by a customer (Process 5.4.1). The DBMS managing D2 processes the query and retrieves data from D2 (Process 5.4.2). The DBMS then transmits it to a NLP summarizing system which formats data and outputs it in proper form for the customer (Process 5.4.3).

The final sample sentence is used to trace processes for plotting data on map displays. Parsed data, from sentence three, stored in D2 is retrieved and examined (Process 5.2.1). Although all slots are important, the main meaning slots of interest include ***Actor*** and ***Location***. These fields provide unit identification and geographic data. An icon corresponding to unit identification is found and assigned to the data (Process 5.2.2). Location data from the ***Location*** MRS is cross referenced with tables from D3 (Process 5.2.3). D3 also provides appropriate digital maps for the area of interest. The icon is then plotted on a digital map (Process 5.2.5) with associated amplifying text and scope provided by the customer (Process 5.2.4).

This section summarized how a sample piece of textual data was input to the system, stored, processed, and made ready for display. The next section details the output displays and their associated benefits.

Taken by themselves, the events described by the data seem to be unrelated and unmanageable. In short, the events perfectly illustrate the nature of the CAS. The daily summaries, by themselves, do not present a fused, all source picture of what is occurring. The displays will solve this problem.

D. SYSTEM OUTPUTS (GRAPHICAL REPRESENTATIONS)

Next, I simulated the operation of the visualization processors that take the data in its second form, process it and display the data for the decision-maker and cognition engines. The following graphics are examples of what these displayed outputs would look like. I have also included some descriptions of the information that is now conveyed by the graphics (easier pattern recognition, etc.)

The timeline displays allow the decision-maker to relate variables of different values via time. These displays, viewed over some time period, aid in pattern detection and assignment of relationships (what event actually influenced, or caused, another event to occur).

These displays show civilian causalities in Sarajevo (both killed and wounded), attacks on Sarajevo, attacks on UN protected cities and towns, UN responses to events, diplomatic efforts, and world opinion. The displays result from the transformation of the gathered data (in textual format outlined earlier) to pictures. This transformation of text-to-pictures allows the decision-maker to analyze a great deal of data and integrate it in a single glance.

The pictures are chosen to convey the essential information contained in the data. For example, on the display for ***Safe Area Attacked,*** the size of the explosions are relative to the intensity of the conflict as described in the input data (natural language text). Large explosions equate to reports of heavier fighting. For the causalities a line graph of the total cumulative injured is displayed. If the UN responded, then an icon (a

dove in this case) is present. The diplomacy variable is displayed as a thumbs-up or thumbs-down (good or bad) symbol. Other representations could include a face. The size and expression of the face convey the general response [Chernoff73]. A large smiling face connotes something positive while a large frowning face equates to displeasure. In this case, thumbs-up or down, the size of the icon also represents the intensity of the described event. An appearance of a larger icon represents a more vocal sentiment or reaction. The world opinion section uses hand gestures, as well, to convey information. All of these icons can be user defined to correspond to specific nouns, verbs or events. Amplifying data is presented to clarify the graphics. For example, explosions are accompanied by the name of the town attacked.

Figure 5.1, the sample Timeline Display, would be constructed in the following manner by the system. The MRS of data retrieved from D2, the Parsed Data Store, are examined. The slots corresponding to ***Actor, Verb, Object, Time***, and ***Location*** are used by a visualization processor that associates the words in the MRS with appropriate icons. Following the example sentence from the previous section, the system associates the ***Actor*** slot, which is filled with ***Attack***, to a skull and crossbones icon. The time slot is examined and found to contain ***21 July***, no conversion is necessary. The icon, and the data found in ***Time, Verb, Object,*** and ***Location*** (which correspond to ***21 July, Killed, Civilians, 4, Sarajevo***) are classified as Plot Data and are prepared for plotting. The customer provides reference data to the system specifying a timeline display for events for each day in the month of July. The visualization engine combines the requirements and data and graphically outputs the event. Examination of day 21 in Figure 5.1 reveals

that the system plotted a skull and crossbones icon in the ***Attacks on Sarajevo*** row with corresponding increases in the ***Civilian Killed In Sarajevo*** plot.

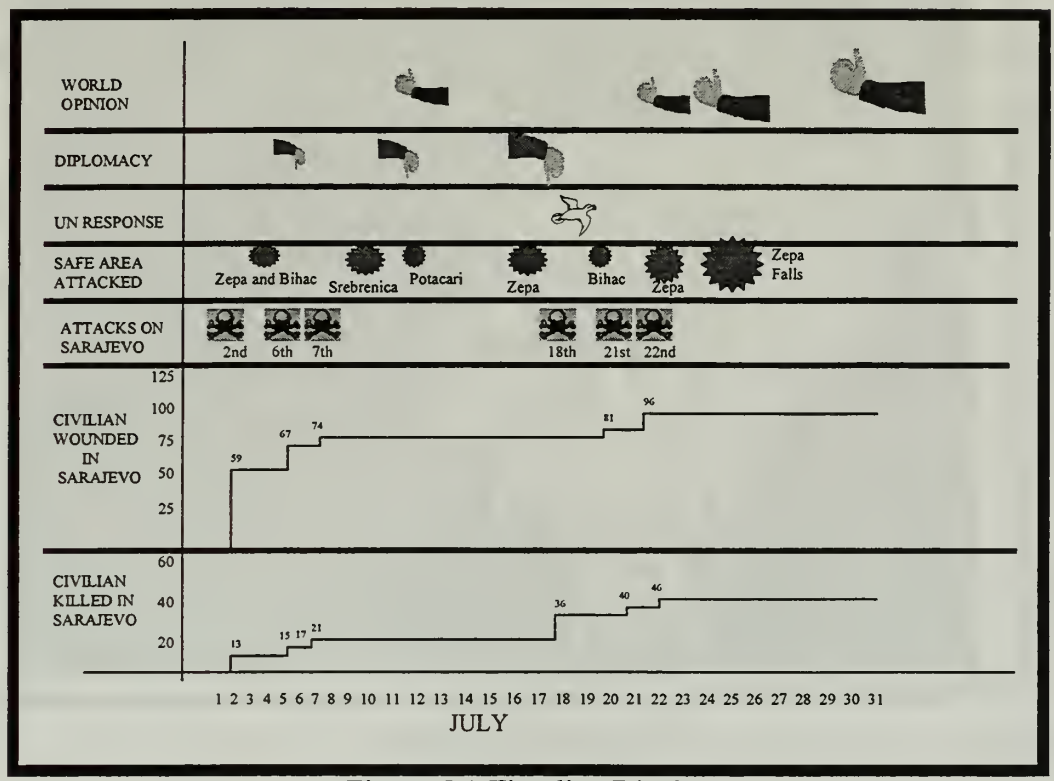

Figure 5.1 Timeline Display

Map creation follows a similar process which was described in detail in Chapter IV. Figure 5.2, Map Display, illustrates how spatial data is displayed. Once again, MRS are examined for data. In this case the slots of interest are ***Actor, Adjective, Verb***, and ***Location***. These slots provide the visualization engines with enough data to associate specific icons to actors described by adjectives. The icon is then plotted on a map retrieved from the NIMA Map Data Store. The system cross-references the data in the ***Location*** slot with geographic reference data provided by the customer or contained in NIMA's geographic databases. This locates the proper point for plotting of the icon. The

data in other meaning slots (***Adjective, Actor,*** and ***Verb***) are also used to create amplifying narrative to accompany the plotted icon.

Figure 5.2 Map Display

An examination of the two displays reveals a great deal of information. The rows in Figure 5.1, Timeline Display, for ***Civilians Wounded and Killed In Sarajevo*** present a running tally of numbers. The increasing numbers correspond to reported ***Attacks on Sarajevo***. The row for ***Safe Area Attacked*** displays the days that the towns were attacked and the reported intensity of fighting (larger explosions equate to more intense fighting). The ***U.N. Response*** row shows when the U.N. governing body had some response to the events displayed in the first four rows. The ***Diplomacy*** row displays the Bosnian

government's responses to the events transpiring while the ***World Opinion*** row presents the sentiments of the rest of the world.

The map displays troop movements and areas where combat was reported. Supplemental narratives accompanying the icons clarify the specific event and actors.

Now it becomes obvious to the decision-maker that events were transpiring that were forcing the system (peace keeping efforts in Bosnia) out of acceptable limits. The timeline and map displays reveal the following information.

1. Continued attacks on Sarajevo were causing a great deal of civilian casualties. The casualties increased at a higher pace with larger numbers of dead and wounded coming in each subsequent attack.

2. Lack of U.N. response to Serbian aggression seemed to encourage stronger attacks on supposedly U.N. protected safe areas.

3. The diplomatic response by the Bosnian government increased in displeasure to the events transpiring. As the casualties mounted and the U.N. did little, the Bosnian government threatened grave diplomatic action against the U.N. (ejection of peace-keepers and revocation of the U.N. peace-keeping mandate).

4. World opinion, in the form of support for the Bosnian government and against Serbian aggression and U.N. idleness, also continued to increase.

5. Troops from neighboring countries became involved as fighting intensified.

Some form of controlling action was imminent, but there was a definite problem in how long it took for a decision to be made to take action (NATO air strikes). Was it because no one realized that events were increasingly spiraling downward and out of

control (a possibility if there was an inability to sort through and exploit the available data) or some other more sinister or political reason? I hypothesize that it was the former. They failed to realize how bad the problem actually was. Decision-makers were unable to cognize the underlying problems of the situation in a timely manner. They utilized the common mental models for decision theory and attempted to satisfice the problem based on a limited understanding of the data. An incremental approach in decision making prolonged the decision cycle. A cybernetic C4 system, as I have described in the previous chapter and operating as described in this chapter, would have pointed to an out-of-limit situation needing decisive action much earlier in the decision cycle.

This system supports the decision-maker by augmenting the decision-maker's judgment and expertise in the following areas: [Bhargava96]

1. Data search and retrieval, interpretation, storage, and visualization;
2. Problem identification;
3. Creation and choice of alternative solutions.

The system, operating as described and supporting a decision-maker in the above mentioned areas, could shorten a decision-maker's OODA Loop and place him in greater control.

VI. CONCLUSIONS

A. SUMMARY

This thesis was an investigation into how the decision-making process could be improved. Specifically, this work dealt with military command and control systems and the feasibility of improvement with the application of cybernetics to these systems. A conceptual design for a new Cybernetic Command and Control system was outlined and its operation illustrated.

I discussed the changing nature of threats to U.S. security and the resultant need for improved C4 systems as background material in Chapter I.

Chapter II contained background information on the fundamental concepts of C4 systems and general descriptions of existing C4 systems and their functional purposes. I also discussed the future of C4 systems and the need to change the paradigm of these systems from one of operating to support conflict resolution to one of supporting conflict deterrence. Background on Artificial Intelligence was introduced in this chapter as was Cybernetic Theory. My reason for choosing cybernetic models to improve the C2 process (aids in increased understanding of complex adaptive systems through accumulation and analysis of empirical data) concluded this chapter.

I presented a conceptual design for a Cybernetic C2 system, a basic concept of operations, and a brief illustration of that concept in Chapter III. I detailed the system design by analyzing the system requirements with DFD's and explained the processes involved in making the system function in Chapter IV.

Finally, Chapter V presented a description of system implementation. I achieved this by simulating, by hand, the functions of the system. Sample inputs, processing, and output displays were presented.

B. RE-ADDRESS THESIS QUESTIONS

I will summarize the findings by re-addressing my research questions posed in Chapter I.

1. Main Questions

How can cybernetics be used for command and control? What are the advantages and disadvantages of using cybernetics? The goal of command and control is recognizing what must be done and seeing to it that necessary steps are taken to achieve that goal. Cybernetics, as explained in Chapter II, offers decision-makers the chance to increase control of a system. It does this by: 1) Helping decision-makers identify, in complex adaptive systems, determining and controlling factors, or variables; 2) Cybernetics offers a continuous view of a system's state over time and the variables (and their relationships) affecting that state; 3) Cybernetics encourages rapid monitoring of actions and feedback, through information, to help a decision-maker re-orient, decide, and act quicker. Cybernetic processes, however, are hampered by their need to accumulate and analyze tremendous amounts of data. Cybernetics utilizes empirical processes to analyze the observed system and therefore is reliant on high speed, computationally intense processors.

What are the hardware, software, and data requirements for establishing a Cybernetic Information System? The design and requirements for the system was presented in Chapters III and IV. The hardware for the system design includes various input and output devices for entering and displaying data, a memory for storage of historical data, and to facilitate machine learning/pattern recognition, and AI processors. The associated software to operate these devices, as well as the devices themselves, can be realized. The data required for system operation was detailed in the Data Flow Diagrams in Chapter IV.

2. Secondary Questions

What data will be required for system operation? Chapters III and IV outline required data and the data flow through the system. Data on system disturbances, available resources, and goals of the decision-maker are required for system operation. These constitute all the variables present in a system. This data can take many forms and can be found in many sources. Data is also required for the visualization engines in the form of maps and tables listing place names and corresponding latitudes and longitudes. The customer must also provide amplifying reference data to help resolve ambiguities and scope problems. The system will operate better with more data provided in these three areas since cybernetics employs empirical modeling techniques (analysis of large sets of possibilities over time). The more data that is available often results in better solutions.

Data in some form of commonsense knowledge module with background data, reasoning and logic rules is also required, as briefly discussed in Chapter V.

What is the best representation for providing the required data for analysts' interpretation? Pattern recognition by humans is conducted more easily for data presented visually vice textually. Visual displays (maps and timelines), shown in Chapter V, provide enormous amounts of information that can be processed and assimilated by the human brain very rapidly.

How can a system enhance control of a situation? How can the system aid analysts in recognizing bifurcation points and what benefit would early recognition provide? As discussed in Chapter III and V, the system would enhance control by improving the decision-makers ability to recognize patterns and relationships existing among system variables. This recognition allows the decision-maker to understand the situation quicker and better. When recognition of out of limit events and patterns occur the decision-maker's OODA loop is shortened. The decision making process is now executed faster and with greater confidence. This increased speed in recognizing a need for action and deciding on a course of action is what makes a decision-maker's understanding better.

What impact will the system have on current capabilities for command and control efforts? This system, as envisioned, would not replace current C4 systems and C2 efforts, but instead would support and complement the overall command and control process. It will fill the need for a system that supports possible conflict identification and

deterrence. Chapter III discusses how it will provide an opportunity for decision-makers to shorten their OODA loop and better control a situation.

Can a cybernetic system allow one to predict, forecast and recommend courses of action? This question can not be answered definitively, but Chapters II and V offer some insight. Success in these endeavors depends on what is being forecast and on the level of technology implemented in the system. Since the system is designed to deal with complex adaptive systems, the prediction confidence may be low. A CAS' ability, and penchant, for continuous change hinders the prediction effort. The CAS constantly monitors itself and makes changes to facilitate survival. At the same time, though, the employment of continuous monitoring, or feedback, through cybernetic modeling techniques helps the decision-maker recognize and react quicker to these adaptations. Although improvements in prediction and forecasting may be marginal, a great increase in added control can be realized through the cybernetic process.

How can pattern recognition capabilities of analysts be improved beyond current capabilities? How can existing technology be integrated and used in the system? By providing the analyst with advanced pattern recognition processors and software and training them to use them correctly. Some technology exists as COTS and can be used today while others require more research and development. Augmenting the human analyst's brain with an AI device will allow searches over larger sets of possibilities.

How can the system focus the analysts' time, currently spent on the minutiae of reading and plotting data, to allow more time for pattern recognition, prediction and

steering recommendations? Chapters IV and V suggest that using Natural Language Processors and Interfaces will dramatically reduce the human effort spent on reading reports, searching for relevant material, and inputting data. Visualization engines that present data for rapid assimilation and pattern recognition by an analyst will help. Automation of these functions allow analysts to spend more of their time studying the relevant data and trying to synthesize and comprehend.

C. RECOMMENDED AREAS FOR FURTHER STUDY

More work is necessary on developing many of the tools and technology required for this system to be realized. Specifically, work on the processors is required. There are some Natural Language and Visualization Processors available but overall they exist at rudimentary levels. Also required are processors that can semantically interpret processed text and assign meaning in a domain independent fashion. These processors are probably the most advanced components required

A study on how this system could be integrated into the existing C4I architecture would also be beneficial. One could analyze the value added nature of this system and cost benefit tradeoffs for investing in deterrence efforts.

Work on searching for data in more efficient means (e.g. using intelligent agents, data pull vice push technologies, etc.) is also recommended. Getting the right data for analysis at the beginning of the cycle would eliminate wasted time processing and synthesizing irrelevant data later.

Finally, investigation into the possibility of integrating a simulation of an opponents perceived OODA loop, and how an opponent is attempting to increase their own control effort, is recommended. If the system could be modified to act as an opponent, using the same input data (but viewed through an opponent's eyes with resources now classified as disturbances and vice versa), then knowledge of possible enemy susceptibilities and weaknesses may become more apparent.

LIST OF REFERENCES

[Abramson94] Abramson, Myriam. *Using AI for Counter Narcotics*, IEEE Expert, October 1994.

[Alshawi *et al* 88] Alshawi, H., van Eijck, J., Moore, R.C., Moran, D.B., Pereira, F.C.N., Smith, A.G., and Pulman, S.G. *Interim Report on the SRI Core Language Engine, Technical Report CCSRC-005*, SRI International/Cambridge Computer Science Research Center, July 1988.

[Arens97] Arens, Yigal and Hovy, Eduard. *The Design of a Model-Based Multimedia Interaction Manager*, Internet Article 1997.

[Ashby84] Ashby, W. Ross. *An Introduction to Cybernetics*, Methuen and Co., New York, NY, 1984.

[Barr81] Barr, A., and Fiegenbaum, E. A. *The handbook of Artificial Intelligence I*, William Kaufmann, Incorporated, Los Altos, Ca, 1981.

[Bhargava97] Bhargava, Hemant K. and Jacobson, David L. *Genetic Storms: Investigating the Gulf War Syndrome,* Proceedings of the Thirtieth Hawaii International Conference on System Sciences, Maui, January 1997.

[Bhargava96] Bhargava, Hemant K. *Decision Support Systems IS4185*, Class Lecture Notes, 1996.

[Boyd87] Boyd, John R. *A Discourse on Winning and Losing,* Briefing Slides, Maxwell AFB, Alabama, August 1987.

[Canamero96] Canamero, Dolores. *Plan Recognition for Decision Support*, IEEE Expert, June 1996.

[Chernoff73] Chernoff, H. *The Use of Faces to Represent Points in K-Dimensional Space Graphically*, J. American Statistical Association, 1973.

[Chung94] Chung, Mihwa. *Applying Parallel Processing to Natural Language Processing*, IEEE Expert, February 1994.

[Davis90] Davis, Ernest. *Representations of Commonsense Knowledge*, Morgan Kaufmann Publishers, Inc., San Mateo, CA, 1990.

[Geyer94] Geyer, Felix. *The Challenge of SocioCybernetics*, Internet, July 1994.

[Howland94] Howland, Daniel. *Cybernetic Modeling for Situation Control*, DIA Study #17505-798-94, Department of Defense, 1994.

[Howland90] Howland, Daniel. *The Cybernetic Modeling of Soviet Systems*, DIA Study #1800R-075-90, Department of Defense, 1990.

[Howland88] Howland, Daniel. *A Cybernetic Analysis of Soviet Troop Control*, DIA Study #1800r-075-88, Department of Defense, 1988.

[Jenner94] Jenner, Richard A. *Changing Patterns of Power, Chaotic Dynamics and the Emergence of a Post-modern Organizational Paradigm*, Journal of Organizational Change Management, Vol. 7 No. 3, MCB University Press, 1994.

[JC4-95] *Joint Command, Control, Communications, and Computer Systems Descriptions Vol. II*, Joint Chiefs of Staff, Department of Defense, 1995.

[JP0-2-95] *Joint Pub 0-2 Unified Action Armed Forces (UNAAF),* Joint Chiefs of Staff, Department of Defense, 24 February 1995.

[JP6-0-95] *Joint Pub 6-0 Doctrine for Command, Control, Communications and Computer (C4) Systems Support to Joint Operations*, Joint Chiefs of Staff, Department of Defense, 30 May 1995.

[JV2010-96] *Joint Vision 2010*, Joint Chiefs of Staff, Department of Defense, 1996.

[Keagle85] Keagle, James M., Maurer, Alfred C. and Tunstall, Marion D. *Intelligence Policy and Process*. Westview Press, Boulder, CO, 1985.

[Ludlow92] Ludlow, Nelson D. *Pictorial Representation of Text: Converting Text to Pictures*, Ph.D. Thesis, University of Edinburgh, 1992.

[Ludlow88] Ludlow, Nelson D. *An Automated Conversion of Narrative English Text of Varied Subject Matter to a Structured Data Base.* Masters Thesis, Wright State University, Dayton, OH, 1988.

[MCCP] *Command and Control*, A U.S. Marine Corps Concept Paper, C4I Division, Headquarters, U.S. Marine Corps.

[Morowitz95] Morowitz, Harold J. and Singer, Jerome L. *The Mind, the Brain, and Complex Adaptive Systems*, Addison Wesley Publishing Co., Reading, MA, 1995.

[Pospelov86] Pospelov, D.A. *Situational Control: Theory and Practice*, Nauka Publishers, Moscow, 1986.

[Sheehan97] General Sheehan, Superintendent's Guest Lecture, Naval Postgraduate School Monterey, CA, 1997.

[Simpson88] Simpson, Robert L. JR. *DOD Applications of Artificial Intelligence: Successes and Prospects*, SPIE Vol. 937 Applications of Artificial Intelligence VI, 1988.

[Sundheim91] Sundheim, Beth. *Initial Results from MUC-3 Conference*, Natural Language Processing System Workshop, DARPA/Rome Laboratory, 1991.

[Whitebread95] Whitebread, Kenneth R. *Information Discovery in High Volume, Frequently Changing Data*, IEEE Expert, October 1995.

[Wiener61] Wiener, Norbert. *Cybernetics, or Control and Communication in the Animal and the Machine,* MIT Press, Cambridge, MA, 1961.

APPENDIX

Section - II
C4 Systems Descriptions

C4 Systems Descriptions

This section presents a short synopsis of C4I systems description found in CINC C4 systems master plans, and Service and agency documents. It is intended to be a short reference for the C4I assessment process.

ALARM. The ALARM system will provide worldwide detection and tracking of ballistic missiles during launch and boost phases. The ALARM replaces the terminated FEWS program as the planned follow-on to the current Defense Support System (DSP). The complete ALARM system will consist of a constellation of satellites providing continuous surveillance of the earth's surface with short- and medium-wave infrared sensors. The sensors will detect ballistic missile (ICBM, IRBM and SLBM) launch. On-board processing will initiate missile tracking and provide a determination of missile type. Processed data will be provided to a satellite ground station for man-in-the-loop assessment of events and forwarding to all users. The ground segment includes relocatable terminals and relay ground stations.

ACE High Network. A terrestrial network of medium capacity tropospheric scatter and line-of-site microwave links, ACE HIGH provides transmission capability to NATO subscribers. It extends in a geographical arc from Norway to Turkey. Branch routes from the main network trunk provide circuits to user concentrations. Wartime utility is marginal, as there is no reconstitution capability. ACE HIGH is being replaced with the NATO Terrestrial Transmission System (NTTS), which will be an all-digital multichannel communications network.

Advance Combat Direction System (ACDS). The ACDS is one of several Combat Direction Systems (CDS) in use in the fleet. CDS is a generic term encompassing the Naval Tactical Data System (NTDS), ACDS Blocks 0 and 1, and the Tactical Data System (TDS) aboard amphibious ships. The CDS is the primary means for monitoring the overall tactical air, surface, and subsurface environment, and is the central repository for all tactically significant tracks for the battle force/battle group (BF/BG) as well as the ship in which it is resident. The CDS consists of equipment, computer programs, and personnel who are engaged in collecting, correlating, displaying, and disseminating own-ship and force track information, evaluating track threat potential, assigning own-ship weapons, generating and disseminating force orders, and monitoring own-ship and force engagements.

Advanced Cruise Missile (ACM) Mission Planning System (MPS) (ACM MPS). ACM MPS provides assistance to integrate, operate, test, maintain and enhance software and related data used to model ACM missions.

Advanced Data Controller (ADC). ADC provides fast and reliable error-free data transfer over secure, UHF SATCOM communications channels. ADC also provides networking features that allow many users to cooperatively share a single channel. ADC comes in a rugged, TEMPEST chassis with a menu-driven, user-friendly, man-machine interface.

Advanced Field Artillery Tactical Data System (AFATDS). AFATDS is one of five principal components of the Army Tactical Command and Control System (ATCCS). As a battle management system, AFATDS will provide automated fire support for close, read, and deep operations, and non-nuclear and chemical fire support assets. AFATDS will enable the artillery commander to receive a request for a fire support mission, select the ammunition, assign the firing unit, and calculate the ballistic solution in a matter of seconds. AFATDS is composed of a common suite of hardware and software employed in varying configurations at different operational facilities (or nodes) interconnected by tactical communications. Both hardware and software will be capable of being tailored to perform the fire support command, control, and coordination requirements at any level of command. Replaces TACFIRE.

Advanced Narrowband Digital Voice Terminal (ANDVT). ANDVT is a joint program to provide a narrow band terminal to enable secure voice/data exchange for ship, aircraft, land mobile, and fixed applications using high frequency (HF), very high frequency (VHF), ultra-high frequency (UHF) or UHF satellite radios, wire lines, or 2.4 kilo bits per second digital transmission equipment. Data rates are 300, 600, 1200, and 2400 bits per second. The program consists of three individual systems: TACTERM for ship/shore, mobile/vehicular, and airborne uses; Satellite Voice Terminal for narrow band secure voice via SATCOM; and MINTERM, KY-99, low power man pack version.

Advanced Planning System (APS). APS is the prime air tasking order (ATO) generator for the Contingency Tactical Air Control System (CTACS) Automated Planning System (CTAPS). APS has automated inputs from intelligence, jamming, targeting, routing, airspace management, and logistics subsystems. APS has the capability to a) Build interdiction and offensive counter air mission packages; b) Schedule flows for close air support, defensive counter air, and air refueling missions; c) Plan reconnaissance and support missions; d) Track tanker fuel, weapons, and aircraft assets; and e) Display the air battle plan at any point in the process to gauge adherence to the commander's guidance.

Advanced Single Channel Manpack (ASCAMP). This extremely high frequency (EHF) man-portable system will meet a critical need for worldwide assured voice and data via satellite communications in a severe electronic warfare environment. It is intended to operate in an intense jamming environment, having a low probability of detection and intercept.

Advanced Support Interactive Control System (ASICS). ASICS is a graphics package used to graphically display and manipulate CMARP run results and Combined Mating and Ranging Planning System (CMARPS).

Advanced Tactical Air Command Center (ATACC). An improved system for C2 of Marine Air Ground Task Force (MAGTF) air operations that will provide the tactical air commander with the facilities needed for planning, controlling, and coordinating MAGTF air operations. The TACC, AN/TYQ-1; Tactical Data Communications Central, AN/TYQ-3A; and associated equipment currently employed to support the TACC are inadequate to meet the projected operational requirements in the 1990-2000 time frame. The TACC consists of two mutually supporting sections equipped for carrying out planning and operational functions. The ATACC will provide the TACC with a planning segment and an operations segment consisting of hardware and software designed to accomplish TACC functions. The ATACC-supported TACC must function in concert with other agencies to provide responsive direction and coordination of MAGTF air assets in the accomplishment of its responsibilities. The ATACC will provide the versatility to deploy TACC planning and operational segments commensurate with the functions of Marine Expeditionary Brigade (MEB) and MEF and to build up or scale down its capabilities by augmenting, reconfiguring, or reducing modular segments of the system as operational requirements change.

Advanced Tactical Airborne Reconnaissance System (ATARS). ATARS is an advanced airborne sensor system that uses either a digital low-altitude electro-optical (EO) or an infrared (IR) imaging system to be carried on either fixed wing aircraft (i.e., US Air Force F-16s, or US Navy/US Marine Corps F/A-18RCs) or on the joint-service extended or medium-range unmanned aerial vehicles (UAVs). In addition, the digital imaging radar, the advanced synthetic aperture radar system (ASARS) is being developed for use in both fixed wing aircraft and UAVs. These sensor systems provide the Services with an all-weather, day- night, real-time imaging collection capability. The airborne reconnaissance platform will be able to relay the collected imagery to the associated afloat/ashore processing facility, the Joint Services Imagery Processing System (JSIPS), through a digital down link, for real time processing and dissemination.

Aerial Port Documentation and Management System (ADAM III). ADAM III (cargo portion of the Consolidated Aerial Port Subsystem) is an Air Mobility Command (AMC) unclassified system for automating cargo processing operations at major Aerial Ports Of Embarkation (APOEs) with high traffic workloads. It records receipt, staging, and loading of cargo at APOEs and prints out the aircraft cargo manifest upon completion of loading. ADAM III will be replaced by CAPS II.

Aeromedical Patient Evacuation System (APES). APES is an automated system to assist in manifesting patients for med-evac flights and scheduling med-evac flights and crews for subsequent patient movements.

Afloat Correlation System (ACS). The ACS will be part of the Navy C2 system afloat; and, when introduced into the fleet, will be part of the Navy Tactical Command System Afloat (NTCS-A) umbrella program that will be installed on all CV/CVNs, and flag configured ships (including Amphibious flagships). It is an automated information management system that

incorporates the functions of Prototype Ocean Surveillance Terminal (POST), and integrates all contact and threat warning data from external sources and sensors with data from BF/BG sources and sensors. ACS has separate general service (GENSER) and sensitive compartmented information (SCI) processors which are integrated via cryptologic interface devices (CIDs). The ACS provides automatic multiple emitter to platform correlation, a multiple hypothesis geographic tracker, and combined automatic parametric, attribute, and geopositional correlation. Automatic ambiguity resolution and improved throughput with parallel processing will greatly improve the timeliness and consistency of the resulting tactical picture of up to approximately 4,000 miles from the BF/BG. The ACS will improve the Navy's fighting capability by extending the BF/BG commander's tactical horizon beyond the limited range of organic sensors, by providing improved all-source correlation and tactical threat warning, and by supporting Over-the-Horizon Targeting (OTH-T). The ACS integrates SCI with GENSER data in order to provide the CDS with sanitized track updates and tactical threat warnings. The ACS will provide tactical naval forces with the capability to process the sensor data rates anticipated by the late 1990s from new and improved wide-area surveillance and intelligence sensors and have the capacity to operate effectively in the 1990s advanced sensor environment.

Afloat Planning System (APS). APS supports TOMAHAWK mission data planning for TOMAHAWK land-attack missiles (TLAM), and will move afloat when the APS is deployed, together with the TLAM Block III Upgrade. which adds a satellite global positioning system (GPS) navigator to the missile. These advances will shorten planning time and provide a capability dedicated to the battle group commander's specific, localized interests. It will also allow mission routes to be generated over areas where no missile navigation terrain contour maps exist, further expanding the number of targets at risk. APS can modify mission data on current tactical, environmental, and intelligence information, including data from hard copy imagery such as Tactical Airborne Reconnaissance Pod System (TARPS). It can also generate a full conventional mission including route plans, maps, and navigation and target data from stored data.

Air Carrier Analysis Support (ACAS). The Air Carrier Analysis Support System (ACAS) provides performance measures for interpretation by experienced DOD analysts. (ACAS cannot forecast a tragic air accident, nor can it judge whether one carrier will be more or less safe than another on the next DOD mission.) ACAS can assist experienced analysts in spotting unfavorable trends and/or deviations from normal patterns of behavior and can focus the attention of DOD personnel on those carriers most in need of closer examination.

Air Command And Control System (ACCS). The NATO ACCS program is an evolutionary command and control system design and architecture to integrate planning, tasking and execution functions for tactical air operations throughout Allied Command Europe (ACE). ACCS sets the standard for upgrade of existing antiquated C3 systems. ACCS will use the

NATO Terrestrial Transmission System (NTTS) as well as host nation networks and user nation tactical communications.

Air Force Air Request Net (AFARN). AFARN is a dedicated HF single sideband (SSB) net used by Tactical Air Control Parties (TACPs) to transmit requests for tactical air support to Air Sector Operations Centers (ASOCs) or Airborne Battlefield Command and Control Centers (ABCCCs) in the event the ASOC cannot be reached. The ASOC serves as Net Control Station. The AN/MRC- 107A mobile communications center, transported on a utility M-151 truck, is used by the TACP to establish this net with the ASOC or ABCCC.

Air Force Command and Control System (AFC2S). The AFC2S program will provide an integrated data base structure to support C2 planning of USAF conventional combat and support forces throughout the conflict spectrum (peace through global war). Seventy–three command–unique systems and 10 standard Air Force systems will ultimately comprise the AFC2S integrated data base structure.

Air Force Integrated Communications Network (AFNET). AFNET is one of nine "Stove-piped" systems being integrated into a common user network (e.g. with NAVNET and DLANET) as part of the DISN - Near Term effort. The AFNET is a worldwide diverse, multi-use network, which includes an interconnection with the DCTN. The DISN-NT consists of long-haul common-user facilities, equipment, and services among and between the Services and Agencies to support information exchange needs for various users.

Air Force Mission Support System (AFMSS). AFMSS was conceived by the general Officer Steering Group as the migration Mission Planning System for the Air Force and US Special Operations Command, replacing the existing "stovepipe" systems for individual aircraft and weapons by 1999. It provides automated pre–mission planning and materials preparation, post–mission debriefing and data acquisition and management capabilities on a commercial workstation platform.

Air Force Rescue Coordination Center – Management Information System (AFRCC–MIS). Management Information System—Employed to better manage Search and Rescue (SAR) activities, both military and civilian, within the Continental US. Upon completion, plans are to make it available to all Rescue Coordination facilities around the world.

Air Force Resource Management System (AFORMS). AFORMS provides aircrew information to flight operations managers. Information includes flying experience, training, readiness, qualification, and incentive pay eligibility.

Air Force Wing Command And Control System (AFWCCS). AFWCCS provides Tactical Air Forces (TAF) wing commanders and their battle staffs and automated, secure, survivable, command and control system. The system provides a near real

time, accurate, composite picture of wing resources to support combat sortie generation and reporting. AFWCCS is the primary recipient of the air tasking order (ATO) from CTAPS.

Air Terminal Communication and Control System (ATCC). ATCC provides Command and Control (C2) information about logistics activities (i.e., airlift schedules) via a central data base at Wright-Patterson Air Force Base.

Air Vehicle Force Application System (AFAS). AFAS is used to develop aircraft mission routes and enables war planners to define processing parameters. It simulates aircraft routes using aircraft performance, standard planning factors and wind data. AFAS produces flight plan data for all strategic aircraft and command summaries for reconnaissance aircraft. It also produces data for unit level systems which build aircraft cruise missile on-board mission data tapes.

Airborne Battlefield Command and Control Center (ABCCC). The ABCCC consists of an air refuelable EC-130E aircraft equipped with an AN/USC-48 capsule. When manned with its 15 member battle staff, the ABCCC provides a command, control, communications, and intelligence (C31) platform capable of being forward deployed to provide direction to air-ground forces executing the Air Tasking Order (ATO). The ABCCC's extensive communications capability (8 ultra high frequency (UHF), 8 very high frequency (VHF) amplitude modulated/frequency modulated (AM/FM), 4 high frequency (HF), and 3 UHF satellite communications (SATCOM)) combined with its mobility supports a demonstrated capability to communicate directly across the combat arena. The ABCCC system improvement program will incorporate a tactical data link (TADIL) J Joint.

Airborne Warning and Control System Improvements (AWACS Improvement). AWACS improvements will include HAVE QUICK UHF/VHF jam-resistant communications, electronic warfare support measures (ESM) additions to the AWACS surveillance system for passive detection, electronic counter countermeasures (ECCM) enhancements, and improved surface radar picture, and improved surveillance radar computer, and JTIDS Class II/TADIL-J integration. These improvements will enable the AWACS to control fighters in a dense jamming environment and provide jam-resistant connectivity between major C2 elements.

Airlift Deployment Analysis System (ADANS). ADANS is AMC's integrated airlift planning and scheduling system. It prepares movement tables and schedules for Operation Plans (OPLANs), Operation Orders, channel airlift requirements, and tanker schedules. ADANS also assists in transportation feasibility analyses. The primary mission areas served by ADANS are airlift and aerial refueling. The efficient and timely employment of airlift and refueling assets requires an extensive planning, scheduling, and analysis effort. ADANS provides AMC planners and schedulers the automated tools necessary to plan for and schedule the extensive number of air mobility missions flown by AMC during peacetime and contingency operations. ADANS supports the scheduling and planning requirements associated with recurring air-

lift operations known as channels, Special Assignment Airlift Missions (SAAMs), the assignment of specific aircraft to scheduled missions, and the ability to generate mission schedules to support specific war plans. ADANS is interoperable with the AMC's core execution system, the Global Decision Support System (GDSS). Once ADANS produces a schedule, it is forwarded to GDSS where it is flight followed throughout execution. ADANS is a Corporate Information Management (CIM) designated system as a Command and Control support system. ADANS supports the CIM effort by utilizing standard protocols and standards compliant hardware and software. ADANS has made a conscious effort to adhere to an "open systems" approach.

Airlift Services Industrial Fund Integrated Computer System (ASIFICS). ASIFICS will provide a framework for development of a comprehensive information management system for HQ AMC/FMI. This system will support all accounting, budgeting, and analysis functions necessary for the financial management of the AMC Airlift Service. The system will perform the functions of data collection, revenue computation, billing, accounts receivable, tariff development, analytical reports, disputed billing research, financial statement preparation, accounts payable, budget preparation, budget execution, and additional functions as necessary to satisfy other specific information needs of the user.

Airspace Deconfliction System (ADS). Provides a "what–if" analysis capability and supports airspace modifications leading to an effective airspace planning capability at the force–level structure of the AOC. Provides the following capabilities: a) Generate an Airspace Control Order for dissemination as part of the ATO or as a separate message; b) Deconflict airspace based on time, space, altitude, and type; c) Support airspace grouping to allow for planning tomorrow's war and executing today's war.

Alaskan Radar System (ARS). ARS provides surveillance of mainland Alaska. The radars are part of the Joint Surveillance System (JSS) and provide coverage in and near Alaska as a supplement to the DEW line (Sections DANE, DEW, and JSS). The system provides detection, identification, and flight following of all aircraft entering or operating within the Alaskan Air Defense Identification Zone (ADIZ).

All Source Analysis System (ASAS) The ASAS is a ground-based, mobile intelligence processing system designed to provide automated combat situational displays and support to the combat commander in the areas of intelligence and collections management, all-source, target and situation analysis, single and multi–source processing and reporting, electronic warfare, and operational security as well as support to the generation of intelligence products in those areas. Elements of ASAS will provide seamless support to warfighters at Echelons Above Corps to Brigade level. At the Corps and Division levels ASAS will operate at the Analysis and Control Element (ACE). Sanitized intelligence reports and products will be available from the collateral level ASAS. At Echelons Above Corps ASAS will be tailored to meet unique theater requirements. At the Maneuver Brigade and Battalion level ASAS collateral workstations will be employed.

The ASAS architecture is modular in design so that the Division ASAS, or Corps ASAS can be configured differently due to force structure and mission requirements.

Allied Deployment And Movement System (ADAMS). ADAMS is being developed by SHAPE Technical Center under the sponsorship of SHAPE. It will eventually become part of the Allied Command and Control Information System (ACCIS). ADAMS is a tool to support rapid planning and execution of military movements within the Alliance's new focus on crisis response. The current version of ADAMS includes a force request and commitment module, which will be subsumed by ACCIS, and a deployment planning module. The latter allows NATO authorities to prescribe deployment requirements in terms of forces, destinations, and delivery dates. Nations then round out the deployment plan with unit detail in Standardization Agreement (STANAG) 2165 format, complete itineraries, and time lines. Facilities are also provided for Nations to coordinate movement plans. Eventually ADAMS will include modules for movement scheduling and execution monitoring, and for movement simulation and analysis.

Alternate Command Center Mobile (ACCM). ACCM is a transportable command and control (C2) capability designed to satisfy the requirements of a deployed commander in a variety of mission scenarios. The system includes the following major components/subsystems housed in a series of 20 foot containers which can be transported in a C-130 aircraft: a) Multi-transponder super high frequency (SHF) satellite communications system including a 10 foot diameter antenna b) Milstar Air Force mobile command post terminal c) HF transmitters and receivers d) UHF line-of-sight (LOS) and SATCOM transceivers e) Very low frequency (VLF) receiver f) Operations Battlestaff Shelter with seven workstations providing access to the Worldwide Military Command and Control System (WWMCCS), Operational Support System (OSS), Contingency Tactical Air Control System (TACS) Automated Planning System (CTAPS) (ATO portion only), Automatic Digital Network (AUTODIN) access, and office automation applications g) Intelligence Battlestaff Shelter similar to the Operations Battlestaff Shelter which includes a Joint Deployable Intelligence Support System (JDISS), AUTODIN access, and other automatic data processing (ADP) applications h) ADP/Strategic Shelter containing an AN/GSC10 Air Force Satellite Communications (AFSATCOM) terminal, a Communications Support Processor (CSP), and those systems necessary to allow the system to operate in a self-sufficient mode.

Alternate System HQ (ASH). The ASH serves as HQ USEUCOM alternate command center. The ASH is located at RAF High Wycomb, UK and contains essentially the same C3 capabilities as the USEUCOM Command Center (CC). Integrated TW/AA enhancements scheduled for installation in the primary command center will also be installed in the ASH.

Amphibious Warfare Over-the-Horizon (OTH) C2 (AMW OTH C2). AMW OTH C2 will provide accurate real-time information to the command ship on the position and movement of all surface-borne landing craft within the amphibious landing

area. It will display unit identification and positional data in the command ship, disseminate navigational information among force units and provide a digital communications link capable of exchanging pre formatted messages.

AN/SMQ-11 Satellite Receiver/Recorder. The AN/SMQ-11 is the next generation environmental satellite receiver-recorder for use aboard selected Navy ships and shore locations. The AN/SMQ-11 is capable of receiving remotely-sensed data form the Defense Meteorological Satellite Program (DMSP) satellites, the National Oceanic and Atmospheric Administration (NOAA) Television Infrared Observation Satellite (TIROS-N) (High Resolution) satellites, and the Geostationary Operational Environmental Satellites (GOES). The system can provide black and white hard copy prints of the data transmitted by these satellites within three minutes of the conclusion of the transmission. Data retention on magnetic tape without operator intervention permits automatic archiving of consecutive satellite passes for subsequent enlargement and/or enhancements. The AN/SMQ-11 will digitally interface with the Tactical Environmental Support System (TESS) and pass the images to the TESS for interactive analysis, enhancement, enlargement, annotation, and dissemination to other TESS connected systems (such as NTCS-A). The AN/SMQ-11 will provide the Navy with secure, high-resolution, direct readout of visual and infrared imagery in support of warfare areas such as Antisubmarine Warfare (ASW) and Anti-air Warfare (AAW). In conjunction with C3I systems, it will not only support tactical planning and execution, but will improve the accuracy of environmental assessments and inputs as well.

AN/TRC-170(V)3 Troposcatter Radio Set. The AN/TRC-170 provides the capability for SHF transmission and reception of 60 traffic channels for digital voice, analog voice, and quasi-analog or digital data signals. Operational modes include internodal trunking, remote subscriber access, subscriber access, subscriber access at relay, dedicated trunking, and multi-trunking over either LOS distances or troposcatter transmission ranges up to 200 miles. The AN/TRC-170(V)3 will be employed at Marine Expeditionary Force (MEF), Marine Division, Force Service Support Group (FSSG), and Marine Aircraft Wing (MAW).

AN/UYQ-3A Air-Transportable Direct Air Support Central (DASC). The AN/UYQ-3A is an air- transportable shelter equipped to enable Marines to control and coordinate the employment of aircraft in the close support of ground combat forces. The DASC typically operates directly under the Tactical Air Command Center (TACC) or supplements the capabilities of the larger, fixed DASC in a MAW. Seven operators within the DASC have front-panel selection of voice radio communications in the VHF, UHF, and HF frequencies. In addition, each operator can select intercommunications with the other operators or access external telephone communications. The AN/UYQ-3A is designed to operate from the bed of an M-923 truck, from within a suitably modified C-130 aircraft, or from a fixed ground location.

Analysis of Mobility Platform (AMP). AMP is a prototype transportation modeling tool whereby various transportation models can be arbitrarily added to simulate end-to-end transportation movements from a home station to a theater assembly area or

logistics support area. It will provide the national Command Authorities (NCA) with accurate answers to such C2 questions as lift capability, lift required, and closure estimates. Models included in AMP are Mobility Analysis Support System, Model for Inter-theater Deployment by Air/Sea, and the Enhanced Logistics Intra-theater Support Tool.

Anti-Radiation Missile Decoy (ARM DECOY). The ARM Decoy will improve the survivability of the AN/TPS-43E or AN/TPS-75 radar systems. It will use a small, portable, low power radar transmitter.

Anti–Drug Network (ADNET). An integrated, open systems network of workstations, enabling diverse DOD/LEA counter drug operational and intelligence elements to rapidly transfer graphic, text, and contact data classified up to the collateral SECRET level.

Antisubmarine Warfare Operations Center Upgrade (ASWOC Upgrade). This program is a planned upgrade of the ASWOC C2 and ASW Communications (ASCOMM) capabilities. The ASWOC consists of four discrete subsystems: C2 subsystem, acoustic analysis subsystem, ASCOMM subsystem, and facilities subsystem. The upgrade system will have enhanced mission capabilities to support all ASW operations including ASWOC-to-ASWOC and ASWOC-to- Navy Command and Control System (NCCS) nodes data exchange; mission planning; tactical communications connectivity (record, data, and voice) with in-flight mission air-prediction; sensor analysis; contact correlation and reporting of equipment failures; weapon selection; improved and increased use of meteorological and oceanographic products; and system security. Significant reliability/maintainability improvements will also be accomplished by the completion of permanent buildings for housing the ASWOCs.

Armed Forces Satellite Transmitted Radio Service (AFSTRS). A satellite distribution system used to transmit radio news and information programming from the Armed Forces Radio and Television Service (AFRTS) Broadcast Center to AFRTS outlets and self-contained, transportable down link receivers worldwide. Links are via the International Maritime Satellite (INMARSAT) system.

Army Battlefield Command System (ABCS) ABCS is the emerging Army concept for the Army "system of systems" utilizing a seamless architecture evolving from the Army/Tactical Command and Control System (ATCCS) from echelons above Corps through Brigade and below. ABCS will link strategic, theater, Joint and allied C2 systems across the full range of battlefield and operations other than war functions. Major components of ATCCS are: MCS, ASAS, AFATDS, FAAD C2I and CSSCS. Replaces the Army Command and Control System (ACCS).

Army Command And Control System (ACCS) (replaced by ABCS). ACCS is the aggregate program consisting of all the communications and ADP hardware and software which will provide C2 support throughout the Army. It is a collec-

tion of equipment, operating procedures, doctrinal processes and relationships, personnel and organizations. It consists of the Army Tactical Command and Control System (ATCCS), Echelons Above Corps Communications (EAC COMMs), their interconnections, and other Army information management systems.

Army Company Information System (ARCIS) Automated system that runs on existing hardware and is designed to support the company commander in the performance of his information management functions. It contains over 40 task modules to compliment existing systems that support key functions in personnel, training, and readiness.

Army Data Distribution System (ADDS). ADDS consists of the Enhanced Position Location Reporting System (EPLRS) and the JTIDS. Formerly, the two systems were joined in a program known as the Position Location and Reporting System (PLRS)/JTIDS Hybrid (PJH). In the ADDS, EPLRS will provide data communications support for weapons systems, sensors, and C2 elements that have relatively low data throughput requirements. This function is in addition to PLRS functions of providing position location, navigation, and identification information to C2 systems and units equipped with Enhanced PLRS User Units (EPUUs). JTIDS is a broadcast and point-to-point information distribution system that also provides position location and navigation information to its users. JTIDS terminals will provide communication support to weapon systems, C2 elements and other key facilities of Army Air Defense Artillery (ADA) units that require a high volume of data throughput.

Army Food Management Information System (AFMIS). The Army Food Management Information System (AFMIS) provides automated support and management of day-to-day administration of the Army's food service and subsistence supply programs. AFMIS consists of four functional modules which support the dining facilities, food advisors and subsistence supply activities.

Army Global Command and Control System (AGCCS). AGCCS is currently being defined by the Army. It will be the Army component of the Joint Global Command and Control System (GCCS). AGCCS will be built from applications programs developed by the Army World wide Military Command and Control System Information System (AWIS), the Standard Theater Army Command and Control System (STACCS), and the Echelon Above Corps (EAC) portion of the Combat Service Support Control System (CSSCS).

Army Integrated System Control (AISYSCON). An automated theater–wide system that signal S3 staffs will use to manage battlefield information systems. The AISYSCON automates the functions that a signal command system control currently performs manually: network planning and engineering, wide area network management, signal command and control, battlefield spectrum management and communications security management.

Army Special Operations Command Network (ASOCNet). Provides SOF command and control.

Army Tactical Command And Control System (ATCCS). ATCCS comprises all facilities, equipment, communications, procedures, and personnel essential to a commander for planning, directing, and controlling operations of assigned forces. The ATCCS will integrate five battlefield functional areas: 1) maneuver control: 2) intelligence and electronic warfare; 3) fire support; 4) forward area air defense; and 5) combat service support. It will use common hardware and software to permit horizontal as well as vertical flow of data across the five battlefield functional areas. As a part of the ATCCS, the Advanced Field Artillery Tactical Data System (AFATDS) will be the future fire control C2 system. The Forward Area Air Defense Command/Control and Intelligence System (FAADC2I) is the part of ATCCS that integrates all forward areas' air defenses against enemy aircraft and airspace management. The All Source Analysis System (AS) is the Army's computer-based battlefield intelligence system which fuses intelligence information to support decision making. The Combat Service Support Control System (CSSCS) will provide combat support information essential for planning and supporting decision making by tactical commanders. The five systems will interface with one another by three communications systems, the Combat Net Radio, the Army Data Distribution System, and the Area Common User System.

Army World Wide Command and Control System (WWMCCS) Information System (AWIS). AWIS fulfills the Army's Strategic Command and Control (C2) requirement for software, hardware, and databases for the implementation of the Joint Operations Planning and Execution System (JOPES) and other joint service systems that support the Commanders-In-Chief (CINCs) and Joint Chiefs of Staff (JCS). In addition, AWIS modernizes the Army's C2 system supporting conventional military planning and execution. Applications programs developed by AWIS, STACCS, and CSSCS (EAC) will provide the building blocks for the Army Global Command and Control System (AGCCS).

ASSC Communications Upgrade. The ASSC Communications Upgrade will provide dedicated digital data and secure voice connectivity between worldwide space surveillance sensors and the ASSC. It will also upgrade the ASSC communications processors.

Asset Tracking Logistics and Supply System (ATLASS). A supply and equipment management system in support of the MAGTF Commander. ATLASS can be used in garrison or deployed; providing sustainment support to the MAGTF during deployment using material requisitions passed to the source of supply. On-hand assets and replenishment status can be tracked at various echelons, providing accurate logistics posture as an operation evolves.

Asset Tracking Logistics and Supply System II (ATLASS II). A fully deployable system providing integrated field supply and maintenance support to the Fleet Marine Forces. ATLASS II expands on both the functionality and technical capabilities of its predecessor, ATLASS. ATLASS II enhances the performance of logistics operations and provides the commander full visibility and accountability of assets under his control.

Asynchronous Transfer Mode (ATM). The ATM is a method of packetizing digital information by using a fixed cell construction which is independent of data rate and cell switching technology. In ATM, information is divided into short fixed-length entities, called cells, which are provided with flow identification labels, and forward through the network in a way similar to packet multiplexing/switching. It works in conjunction with SONET to permits a very wide range of data rates and services to be collectively integrated and switched within a very high data rate network. ATM cells can also be passed over circuit-switched networks as normal digital traffic.

Automated Message Handling System (AMHS). A combination of hardware and software components that automate the processing and management of messages from origination to destination (writer to reader). These components are used to shield the user from the technical complexities of messaging.

Automated Patient Evacuation System (APES). APES is the AMC automated aeromedical airlift scheduling system. It automates the processes involved in transporting patients to medical treatment facilities worldwide. APES includes automated patient manifesting, itinerary and mission planning, management reporting and inter-agency communication. It interfaces with the Defense Medical Regulating Information System.

Automatic Digital Network (AUTODIN). AUTODIN is a common-user switched message service. It is a principal long-haul, DOD digital network for transmitting message traffic on an automated store and forward basis between switching centers and among a wide variety of fixed or transportable subscriber terminals. The system is designed around remote, interconnected, central processing nodes called AUTODIN Switching Centers (ASC). The ASC also provides the interface for dissimilar terminals to communicate with each other by virtue of code, format, and line speed conversion. Plans call for the AUTODIN to be phased down beginning about the year 2001 and be gradually replaced by a new architecture call the Defense Message System (DMS)

Automatic Identification Program (AUTO ID). The AUTO ID is intended to be a means for rapid, accurate identification of aircraft traffic. It uses Identification, Friend or Foe (IFF) and flight-corridor information. Future sensors, including the IFF and aircraft jet engine signature modulation, will be integrated into the equipment.

Automatic Secure Voice Communications Network (AUTOSEVOCOM). AUTOSEVOCOM provided common user secure voice services since the early 1960s. The system has been replaced by the Red Switch network.

Automatic Voice Network (AUTOVON). AUTOVON is the switched voice system which preceded the current DSN.

Base Information Transfer System (BITS). The BITS is a Local Area Network resident on a base or post used to disseminate, retrieve information , and manage information flow at that location. The base has access to global information through appropriate switches and routers which couple into long-haul connectivity

BCE Automated Support System (BASS). BASS is an Army developed program to allow Battlefield Coordination Element (BCE) personnel in the Modular Air Operations Center (MAOC) to enter target nominations and receive Air Tasking Orders (ATO) information dealing with sorties planned against targets nominated by the Army.

BGPHES Surface Terminal (BGPHES-ST). The downsized AN/SLQ-50(XN-l) is the CV/CVN-based Surface Terminal for the BGPHES. Sensor data from the remoted BGPHES airborne package installed aboard ES-3As and various interservice aircraft is relayed to the ship via the Common High Bandwidth Data Link (CHBDL). The downsized AN/SLQ-50(XN-1) dynamically controls the airborne package, enabling shipboard operators to conduct signals search, analysis, and reporting. Outputs are routed to the BG commander via ACDS and Tactical Intelligence Information Exchange Subsystem (TACINTEL).

Broadband Integrated Services Digital Network (BISDN). The BISDN (which incorporates SONET/ATM technology) is a very high data rate network which is the core of the Objective DII Architecture. Conceptually, the BISDN is no more than an extension of the ISDN to accommodate broadband services. However, in implementation the BISDN uses a mode of transmission that is completely different from the ISDN because of the sheer diversity of services. To accommodate various characteristics and distribution properties of broadband service data, Asynchronous Transport Mode (ATM) technology is employed. It achieves packet-oriented integration of broadband services, and hence has a fundamental difference from that of the ISDN, whose service integration is circuit oriented.

C4I for the Warrior. C4I for the Warrior is a concept that brings to the warrior in standard format: accurate and complete pictures of their battle space; timely and detailed mission objectives; and clear views of their targets. The C4I For The Warrior envisions an information infrastructure which provides for: Seamless operations; Complete interoperability; Common Operating Environment; Flexible, Modular C4I Packages tailored to the Warrior's needs; Horizontal and vertical C2; Over-the-air Updating; Warrior Pull on Demand; Real-Time Decision Aiding; Global Resource Command and Control; Adaptive Safeguards; and Visualization.

Canadian Coastal Radar System (CCRS). The CCRS provides surveillance across the East and West portions of Canada for detection and tracking of inbound atmospheric threat vehicles and for the direction of interceptor engagements. The network also supports peacetime Canadian airspace control.

CANEWARE. CANEWARE is an in-line encryption system for host computers designed to work in an x.25 switched wide area network (WAN) environment. It meets Secure Data Network System (SDNS) standards. CANEWARE uses FIREFLY key management.

Cargo Movement Operations System (CMOS). CMOS is the Air Force's response to the JCS requirement for the Transportation Coordinator's Automated Information Movement System (TCAIMS). TCAIMS is the generic term for the hardware, software, procedures, and other systems that provide integration of the movement information used in the force deployment process from base level to National Command Authority (NCA) level. The Air Force CMOS program is meeting the TCAIMS mandate by automating base–level wartime and peacetime transportation processes to exploit improved efficiency and provide In Transit Visibility (ITV) over cargo moving in the National Defense Transportation System (NDTS).

CAVALIER RADAR. The Cavalier Radar, previously referred to as the Perimeter Acquisition Radar Attack Characterization System (PARCS), provides Tactical Warning and Attack Assessment (TW/AA) of SLBM attacks against the CONUS and southern Canada originating from the near-Arctic areas behind BMEWS coverage. The Cavalier Radar will also provide TW/AA characterization of ICBMs that enter its coverage from Asia. The secondary mission of the Cavalier Radar is to provide space object identification (SOI) as a collateral sensor of the Space Surveillance Network (SSN).

Central American Regional Communications Network (CARCN). Provide a communications network to support US forces, Defense Attaches and Military Groups in Honduras and other Central American countries. Extends DCS into Honduras and provides inter-theater connectivity. Will consist of leased commercial assets and replaces tactical Army communications equipment and personnel deployed to Honduras

Cheyenne Mountain Upgrades (CMU). A collection of six programs designed to enhance overall Integrated Tactical Warning/Attack Assessment (TW/AA) These programs are : Command Center Processing and Display System Replacement (CCPDS-R), Communications System Segment Replacement (CSSR), Space Defense Operations Center 4 (SPADOC 4), Survivable Communications Integration System (SCIS), Granite Sentry, Alternate Processing and Correlation Center (APCC).

CINC's Mobile Alternate Headquarters (CMAH). A ground mobile C2 system designed to deploy prior to hostilities, direct strategic forces during a war as required and reconstitute those forces. Its communications and planning capabilities exceed those of any airborne platform and its survivability and endurability exceeds that of other command centers.

Civilian Vulnerability Indicator Code (CIVIC). CIVIC is a mathematical model portraying nuclear blast and fallout effects on specified targets using specified weapons. CIVIC is a post-SIOP analysis and war gaming program which assesses

damage caused by any attack option. Analysis capabilities include fatality and casualty analysis, damage to installations and fallout doses at monitor points.

CLASSIC CENTERBOARD. CLASSIC CENTERBOARD will provide BULLSEYE with a state-of-the-art database management capability. To manage these sophisticated database capabilities effectively, BULLSEYE will operate as a centralized command and control structure by consolidating the two area net controls in to a single net control located at NCTAMS EASTPAC. Operations will be structured to ensure requirements of all theater commanders are expeditiously and independently addressed. This will be accomplished by ensuring that one or more general purpose workstations are on-line at all times to respond to individual theater requirements as they occur. The BULLSEYE Support Center (BSC) located at Naval Security Group Activity (NSGA) Northwest, Chesapeake, VA, will be responsible for quality assurance and performance analysis of worldwide system performance and for hardware and software standardization. The BSC will provide dedicated resources to optimize overall system performance. To provide this support, the BSC will continuously monitor "on-line" feedback to the net control station (NCS) and outstations when performance is outside established thresholds. The BSC will also perform long-term analysis, including the examination of "performance trends" that will result in "non" real-time, long-term support. The BSC will have the same functional capabilities as the NCS and will execute BULLSEYE DF assignment, fix, and report functions against traditional "accuracy study" and other targets to verify and enhance system performance. A significant enhancement to current BULLSEYE capability is the fact that any CENTERBOARD-equipped outstation can, in addition to DF and acquisition, perform the coordination, fix, and report roles, as assigned on an event-by-event basis. Current plans call for installation of CENTERBOARD general purpose workstations at five outstations. The BSC will be capable of assuming net control, but without the full capability to perform system-wide quality assurance and performance monitoring.

CLASSIC FLAGHOIST. FLAGHOIST is a communications processor that provides the interface for the sensor systems of the BULLSEYE HFDF system with HFDF NCS via a high-speed Packet Switched Network (PSN). FLAGHOIST replaces existing low-speed communications processors. FLAGHOIST replaces the Outstation Processing Equipment Group (OPEG) located at BULLSEYE net outstations and the Buffer Processor Unit (BPU) located at NCSs with new communications host possessors. Each host processor interfaces with the PSN using two general purpose ports connected to an Interface Message Processor (IMP) using X.25 protocols. The FLAGHOIST test configuration consists of the Net Control Communications Subsystem (NCCS), Outstation Communications Subsystem (OCS), and associated peripheral devices. The NCCS is the communications processor that receives, processes, monitors, historically logs, and routes messages between the communications processor (CP)/GYK-3 outstation, and site-selected communication users over the BULLSEYE Communication System (BCS) PSN. The OCS is the communications processor that receives,

processes, monitors, historically logs, and routes messages between the high frequency sensor system, site-selected communication users, and the BCS PSN.

Collection Requirements Management Application (CRMA). CRMA (formerly the Collection Management Support Tool (CMST)) was adopted as the DOD collection management support. CRMA provides all-source collection management support, both in assessing capabilities of collection systems, and in generation and monitoring results to collection tasking requests. In addition, CRMA will consolidate other collection management ADP functions, such as performed by the Advanced Imagery Requirements and Exploitation System (AIRES), thus reducing training and hardware maintenance costs. CRMA full operational capability (FOC) is planned for late 1994.

Combat Area Support Terminal (COAST). COAST is a joint Navy/Air Force project which will be a shore version of the Prototype Analyst Work Station (PAWS), a SIGINT specialized version of the POST. COAST will provide additional map features and land characteristics of land targets that are not available in POST. Ninety percent of COAST requirements will be met by PAWS.

Combat DF. The objective of Combat DF is to provide surface ships with an acquisition, direction finding, and recognition capability against hostile command, control, and communications (C3) signals that will allow the afloat commander to exploit the communications signals of hostile forces to detect and localize the threat. Combat DF satisfies a Chief of Naval Operations (CNO) Operational Requirement (OR) to develop, for smaller naval combatant ships, an integral capability to detect, classify, and locate surface and air threats and to assist in their prosecution. The COMBAT DF System (AN/SRS-1) consists of hardware, software, and firmware that provides a passive-sensor capability to detect and locate hostile targets at long-range and to input this information into the ship's TDS. The design of COMBAT DF is based on the proven technology of OUTBOARD but provides greater flexibility and responsiveness in signal acquisition while reducing space and manning requirements. Combat DF; will he installed aboard LHDs and selected DDG 51 units.

Combat Intelligence System (CIS). Provides force–level and unit–level ops/intel with a standards based ADP capability to support targeting, air operations plan development, ATO target development, situation awareness, threat assessment, mission planning support, battle damage assessment, reporting, and battle staff briefings. CIS provides intelligence data interface to JIC/J2, D/JTF, and weapons systems. CIS is based upon and will provide the functionality of the Intelligence Correlation Module (ICM), Sentinel Byte (SB), Constant Source (CS), and Rapid Application of Air Power (RAAP).

Combat Net Radio (CNR). The CNR is a ruggedized tactical radio used by the warrior on the battlefield. It has anti-jam and encryption capability to help provide information assurance. It can be used in conjunction with Mobile Subscriber Equipment to provide robust tactical connectivity.

Combat Operations Intelligence Center (COIC). The COIC is the intelligence nerve center for the JTF. The COIC receives, assimilates, processes, evaluates and disseminates intelligence information in support of the operational forces. COICs in one form or another are normally located at each of the CINC Command Centers.

Combat Personnel Control System (CPCS). CPCS provides automated support to deployed USAFE commanders with accurate strength accounting during exercises, contingency and wartime operations. It is a personal computer based system with interfaces into AUTODIN.)

Combat Service Support Control System (CSSCS). CSSCS is one of five Battlefield Functional Area (BFA) control systems which make up the ATCCS. CSSCS provides CSS commanders with automated C2 support and a functional interface between the ATCCS and the Army's CSS Standard Army Management Information System (STAMIS) in order that the state of readiness can be assessed and the ability to deploy can be evaluated in near real-time. CSSCS will share four BFAs (Maneuver Control, Air Defense, Fire Support, and Intelligence/Electronic Warfare). CSSCS will be deployed from echelons above corps (EAC), divisions, maneuver brigades/combat brigades to separate/armored cavalry regiments.

Combat Terrain Information System (CTIS). CTIS (in this package) refers to the integration of the Digital Topographic Support System (DTSS) and the Quick Reaction Multicolor Printer (QRMP) programs. CTIS, a low density system, employs the ACOE to the maximum extent possible. CTIS receives IMETS weather products, Defense Mapping Agency and available enemy map data, databases this information, and provides current map overlays and terrain and mobility analyses as either digital or paper copy products. CTIS provides extremely rapid color paper products of the map/terrain output. All products are available worldwide since the CTIS capability is fielded in standard Army shelters and is C-130 capable. There are no plans to migrate CTIS into another system.

Combined Mating and Ranging Planning System (CMARPS). CMARPS is AMC's system for planning movements of deploying tanker and receiver aircraft to provide the most efficient refueling profile. It supports the Deliberate Planning process.

Combo (Combination) Radio. The Combo Radio, AN/ARC-210, provides antijam (AJ) (voice) communications over the UHF and VHF frequency spectrum using a single radio. Its primary application is for AAW and close air support (CAS) operations and will be installed in the F/A-18 first, then in the AV-8B, F-14D, E-2C, EA-6B, AH-1, CH-53, UH-1N, OV-10, and the EP-3. It promotes interoperability with Department of Defense (DOD)/allied HAVE QUICK II and

VHF Single Channel Ground Air Radio System (SINCGARS) communications systems. Both the Navy and Air Force plan to use it as their primary VHF AJ system.

Command and Control Information Processing System (C2IPS). The C2IPS deployable version will evolve, along with the fixed–site C2IPS version to achieve total system interoperability transparent to the deployed functional users. Initial C2IPS functional capabilities and software will be fielded in four increments, with a major release scheduled once each year through the end of 1996. For initial deployment capability, AMC is pursuing a scaled–down, 'node in a box' version of C2IPS. The node in a box integrates the communications processor, file server, and workstation functions into a single terminal. C2IPS software for deployable systems will be fielded in the same four increments discussed above for wing/base–level C2 systems.

Command and Control Processor (C2P). The C2P project uses non-developmental item (NDI) acquisition of standard Navy computers (AN/UYK-43) and develops software programs to interface between tactical and digital communication systems and selected shipboard processors. The processor will provide translation between TADILs A, C, and J and isolate all tactical data link communications equipment, message standards, and protocols from tactical information processors. This will provide a flexible capability for rapidly exchanging tactical information using a single universal database for translating various link formats while remaining completely independent of communications equipment and tactical data computing systems.

Command Center Improvement Program (CCIP). The CCIP will upgrade the USSOCOM Command Center to automate the reporting of force readiness and communications status. The CCIP will allow USCINCSOC immediate access to up-to-date information on all assigned forces to include readiness and deployments. In addition, information on communications status will extend to the SF battalion/SEAL level. The basis for this program is the JCS MROC of 2 April 91 which addresses the common framework for resolving operational deficiencies that exist in fixed command centers.

Command Center Processing and Display System-Replacement (CCPDS-R). A real-time missile warning system for strategic force management, force survivability analysis, and force status monitoring. The CCPDS-R will provide increased capacity and more efficient processing and display of information on ballistic missile attacks and nuclear detonations (NUDETs).

Commanders in Chief Network (CINCNET). Command, control, and communications system designed to provide force location data, intelligence information, weather, unit readiness, satellite data, and data from other sources. This system is supported by the Joint Visually Integrated Display System (JVIDS) software application.

Command Tactical Information System (CTIS). To present near real-time joint information covering all echelons and components for decision making, planning, and support activities at force and unit levels. This is an ALCOM program to handle joint data.

Commander's Tactical Terminal (CTT). The CTT is a secure intelligence reporting device that includes airborne relay equipment installed in the GUARDRAIL (GR)/Common Sensor(CS) and U-2R platforms, ground terminals, and a security data system. CTT is deployed at the Corps, Division, Brigade, and EAC levels. It is a component of the GR/CS system and will replace the obsolete reporting devices used on the earlier variants of GUARDRAIL. CTT sends perishable intelligence reports from GR/CS and the U-2R to remote ground locations and allows field users to request and receive information from GR/CS and the U-2R. CTT has AJ and automatic retransmission capabilities and is a key link in the air/land battle future. To prevent proliferation of multiple non-standard dissemination devices in the force structure, CTT is being upgraded to incorporate the capability to operate in the Tactical Receive Equipment and Related Applications (TRAP), and the Tactical Data Information Exchange Subsystem. B (TADIXS-B) networks. A receive-only version of the upgrade will be fielded to support those users with operational, weight and/or power limitations. In addition, a three channel program upgrade is underway with multiservice commonality and interoperability.

Commercial Satellite Communications Initiative (CSCI). CSCI is a congressionally mandated program to build a commercial architecture to support short and long term communications requirements in a responsive and cost effective manner. It will provide a private worldwide DOD network of leased commercial transponders used to augment the military satellite capabilities of DOD.

Common Airborne Launch Control System (CALCS). CALCS is a system to improve retargeting strategic missiles and provide improved force management capabilities. This program was originally intended for both Minuteman and Peacekeeper systems, but budgetary constraints have limited capabilities for the Minuteman system to downlink commands only. CALCS provides the following capabilities relative to the Peacekeeper system: link to ABNCP aircraft on the status of missiles, ABNCP down link to missile systems allowing retargeting actions and launch, improved EMP hardening, and more reliable/maintainable system hardware.

Common User Digital Information Exchange System (CUDIXS). CUDIXS is the Navy's high-speed message handling system automating both ends of a ship/shore link or a ship termination. The shore end of CUDIXS is the Naval Communications Processing and Routing System (NAVCOMPARS) while the shipboard end is the Navy Modular Automatic Communications system (NAVMACS). Using an automatic polling scheme, each CUDIXS can serve up to 60 ships at 2400 tips via UHF SATCOM.

Communication Support Processor (CSP). The CSP interfaces with AUTODIN to control reception and transmission of message traffic. The CSP accepts two types of messages: General Services (GENSER) and Sensitive Compartmented Information (SCI). CSP is a store and forward processor capable of serving as a front-end processor to different computer systems and will be the heart of the IDHS-95 communication segment. The communications server connected to the CSP has a direct link with the MSDB/IDB and MIIDS/IDB, specifically IDHS-90. A communications server to handle Special Classified message traffic is connected to the backbone network (or SINET) with an interface to MSDB/IDB. Additionally, a Message Analysis Server for CSP data and Press traffic and the MAXI for message traffic are connected to SINET. All messages received or transmitted by the CSP undergo a security check and format validation. MAXI is used for message preparation and release.

Communications Operations Integrated System (COINS ADA). Ada–COINS is an Air Mobility Command (AMC) unique, multi–user, on–line information system that is used to prepare contracts for Airlift Industrial Services Fund (ASIF) and Non–ASIF funded commercial airlift. This system augments Air Mobility Command's airlift mission requirements to account for all money paid to the commercial air carriers.

Communications Support System (CSS). CSS will increase Navy warfighting capability by providing communications capabilities of increased throughput, security, survivability of communication connectivity in a stressed environment, and provide greater responsiveness to user requirements. These significant improvements will be achieved through integration of previously-dedicated systems into one flexible, dynamically-allocable, multimedia communications service. The multimedia architecture will provide users flexible access to all communications links. Radio frequency (RF) links will be treated as common resources, interfaced through a multinet controller. CSS will provide the systems engineering and integration at the equipment and system level for all CSS communication system elements. This project is a systems engineering effort required to define detailed CSS architecture; develop standards for functional protocols and system interfaces; develop system and subsystem specifications; select common hardware and software approaches, prototype and test system components; and integrate systems both in development and procurement. Major elements of the CSS architecture will be developed incrementally through the following primary contributing programs: EHF SATCOM, UFO, UHF SATCOM (Miniature DAMA/Automatic DAMA (Mini-DAMA/auto-DAMA), TACINTEL II), JTIDS/C2P, Naval Modular Automated Communications system (NAVMACS), and the High Speed Fleet Broadcast (HSFB).

Composite Health Care System (CHCS). CHCS is the standard hospital information system for United States (US) worldwide military health care. It connects and integrates all departments, wards and outlying clinics for over 700 health care facilities. CHCS supports administrative, clinical, and financial functions such as clinic patient administration, patient

scheduling, patient/bed management, patient accounting, transmitting, and tracking orders for laboratory, tests, examinations, radiology, and pharmacy results.

Computer Aided Embarkation Management System (CAEMS). An interactive database/graphics tool for producing amphibious, Maritime Prepositioning Force (MPF), and Military Sealift Command (MSC) ship load plans and associated reports.

Computer Aided Load Manifesting System (CALM). Computer Aided Load Manifesting (CALMS) is a microcomputer system designed to automate the load planning of military cargo aircraft. It provides a standard automated capability to store and edit information on air cargo increments. It also allows the user to pre–plan aircraft cargo loads that are used in peacetime as well as during times of war.

Computerized Deployment System (CODES). CODES assists in the pre-stow process to accelerate loading of ships, optimize the use of sea lift cargo space and rapidly reconfigure loads for unit deployment when necessary.

Computerized Movement Planning and Status System (COMPASS). COMPASS prepares US Army unit movement data for inclusion in Operation Plans Consolidated Aerial Port Subsystem II (CAPS II). CAPS II will be AMC's real-time, minicomputer system used at the APOEs to carryout local cargo, mail, and passenger processing functions. It will replace ADAM III (cargo shipment), the Passenger Automated Check-In System (passenger tracking), and the Remote Consolidated Aerial Port Subsystem (CAPS).

Consolidated Aerial Port Systems II (CAPS II). The Consolidated Aerial Port Systems II (CAPS II) Program will integrate aerial port cargo and passenger processing, and aerial port C2 functions into an integrated, client–server based system residing on Open Systems hardware. This program will also develop interfaces to all Transportation Coordinators–Automated Information Management Systems (TC–AIMS) used by all services for airlift. The Consolidated Aerial Port Systems II (CAPS II) Program will integrate aerial port cargo and passenger processing, and aerial port C2 functions into an integrated, client–server based system residing on Open Systems hardware. This program will also develop interfaces to all Transportation Coordinators–Automated Information Management Systems (TC–AIMS) used by all services for airlift.

Constant Web Follow–on (C2W). Formerly the Constant Web database, the C2W XIDB systems support the development and distribution of the Air Force portion of the command control warfare (C2W) portion of the XIDB. The system is used to develop the automated intelligence tools used by intelligence analysts in the AFIWC to populate, maintain, and exploit raw command, control, and communications intelligence (C3I) data. Also will be used by the intelligence analysts at the AFIWC to populate the C2W/XIDB database to support employment of weapons systems. Theater battle managers and strategic planners can use this tool for electronic jamming, targeting, and mission planning activities.

Continental United States Freight Management (CFM). CFM provides Military Traffic Management Command (MTMC) with a comprehensive, automated freight traffic management capability for a cost efficient and effective means for Department of Defense (DOD) activities to procure commercial carrier transportation services and pre-audit bills of lading using electronic data interfaces among shippers, carriers, and finance centers.

Contingency Architecture Model for Planning (CAMP). The CAMP is an interactive software tool which will enable CINCs and Services to conduct contingency communications planning and long range POM planning, from a single database. The CAMP will have significant applicability to C4 resource managers and long range integration planners.

Contingency Intelligence Communications Systems (CICS). The CICS provides contingency intelligence communications support to tactical commanders. There are several systems: a) Scalable Transportable Intelligence Communications System (STICS) is used to interface with national tactical systems; b) National Military Intelligence Support Team (NMIST) is a DIA crisis support element that provides direct all-source, fused national level intelligence to a tactical commander; c) Light Reaction Communication System (LRCS) is a quick reaction SCI contingency communications package developed by and for USCENTCOM; d) International Maritime Satellite Organization (INMARSAT) is a SATCOM commercial service used by USACOM for contingency voice and data intelligence communications; e) Joint Communications Support Element (JCSE) provides special communications equipment for contingency operations. The JSCE can be deployed in a variety of configurations.

Contingency Operation/Mobility Planning and Execution System(COMPES). COMPES captures, stores and reports Air Force deployment operations, logistics, and manpower data from base level through major commands to the Chairman of the Joint Chiefs of Staff (CJCS). It provides Air Force operation mobility planners with the capability to deal with detailed movement requirements at all levels and to summarize these detailed requirements into gross planning data.

Contingency Tactical Air Control System (TACS) Automated Planning System (CTAPS). CTAPS provides automated exchange, processing, and display of friendly and enemy tactical information. CTAPS supports planning, mission execution monitoring and reporting, as well as receipt and dissemination of Air Tasking Orders (ATOs), plans, schedules, intelligence, and weather data through a mix of existing fixed and deployable C4 capabilities. CTAPS has replaced Computer Assisted Force Management System (CAFMS) as the joint service USAF/USN ATO generation medium. Remote SUN Scalable Processor Architecture (SPARC) terminals will be installed in deploying CV/CVNs to support ATO distribution. This is an interim solution until the CTAPS functionality has been integrated into the NTCS-A. CTAPS is designed as a replacement and integration of existing ADP systems. CAFMS is an applications software package within CTAPS, as well as a graphics capability for air route planning. The CTAPS user terminal replaces the present CAFMS user terminal, and is capable of a maximum data rate of 9,600 BPS while users can also be supported

at lesser data rates. CTAPS is responding to the need for a survivable, interoperable, state-of-the-art replacement for the current ADP systems and is focusing in on simplicity, usability, and productivity. It is the USAF's ATO standard as well as an expansion of their ATO interoperability efforts among the services (to include the Army and the USMC) and allies. CTAPS is intended to play a role in the NATO ACCS.

Conventional Mating and Ranging Planning System (CMARPS). The Combined Mating and Ranging Planning System (CMARPS) is used by AMC's Tanker Airlift Control Center (TACC) to schedule the 8000+ air refueling missions flown by AMC, ACC, USAFE, PACAF, AFRES and Guard tankers. The "customers" for these tankers are over 12,000 aircraft from all branches of DOD and NATO worldwide. CMARPS is the group of programs including the Tanker Mating and Ranging Program (TMARP), the Combined Mating and Ranging Program (CMARP) and Graphics Support Interactive Control System (GSICS). CMARP determines if the reconnaissance mission aircraft profile is feasible and how many tankers are required for refueling. GSICS is a single sortie aircraft mission package that can be used to manipulate input data for CMARP/TMARP runs and will provide a map-based visual presentation of the run results.

Copernicus Architecture. The Navy's command, control, communications, computers, and intelligence (C4I) architecture for the post-Cold War era. The Navy is developing a new C4I structure for the next century. Known as the Copernicus Architecture, this comprehensive restructuring will use today's C3I baseline systems as the foundation from which to launch into the C4I technology of tomorrow. Currently in the conceptual stage of its design, the Copernicus Architecture will take approximately a decade to complete. In the Copernicus world, the tactical commander is the center for controlling information flow to support his mission execution. This user centered approach provides the tactical commander control through information pull rather than producer push. Two key elements (pillars) of Copernicus are the CINC Command Complex (CCC) ashore and the Tactical Command Center (TCC) afloat. The other two pillars are GLOBIXs and TADIXs. a) The CCC provides a means to manage the information flow for the ashore tactical commander with sufficient doctrinal and technological flexibility to allow each commander to decide how much and what kind of information he wants. b) The TCC is a generic term for the decision centers of afloat war fighting commanders. The TCC is linked to the CCC by a TADIXS, Tactical Data Information Exchange System. c) GLOBIXs are global, virtual networks imposed on the DCS or commercial systems which tie command and staff organizations in the CCC to joint and/or combined shore sensor and analytic nodes and to other selected communities. d) TADIXSs also link the afloat commander with units under his command and with wide area sensors managed ashore that are not routed through the CCC, and link component commanders to the JTF commander.

Corporate Information Management (CIM). CIM will review layers of policies and management within several functional areas that overlay information systems. As such, CIM's impact will not necessarily be restricted to information systems, but on a larger

scale, how DOD does business. A key element of CIM is the implementation of a computing and communications infrastructure supporting portability, scalability, and interoperability of applications. ASD (C3I) is taking steps to execute the approved implementation plan. These steps include: a) Establishment of a new Center for Information Management within the Defense Information Systems Agency (DISA). b) Oversight to ensure the effective and efficient development, acquisition, and operation of all ADP in DOD. c) Establishment of a DOD Information Policy Council to exchange information management concepts and plans and to provide a forum for the full range of views on achieving the goals of CIM. d) Establishment of an Information Technology Policy Board, chaired by the Director of Defense Information. CIM applies to all Functional Areas including C4I. Current functional groups consisting of OSD officials, Service representatives, and Defense agency functional experts will define current and future business processes. Where cost effective, these groups will develop new DOD systems for Civilian Pay, Civilian Personnel, Contract Payment, Distribution Centers, Financial Operations, Government Furnished Property, Material Management, and Medical Activities.

Corps of Engineers Automated Processing (CEAP). CEAP is a subset of the DISN-NT consolidation effort. It is a CONUS-wide Army Corps of Engineers network consisting of 16 nodes, connected by T-1 trunking. The network uses leased facilities for its long-haul connectivity.

Counter Narcotics/Command Management Control System (CN/CMS). CN/CMS, a joint DOD/DEA/DOJ program, provides computer and secure voice functionality to DOD, DEA, DOJ and other special users at DOD, DOS, and law enforcement agencies in CONUS and OCONUS in support of counter-narcotics operations. The Army is the executive agent for this system; PEO CCS is the Army implementor. Up to 40 sites in 16 countries (to include US) are planned to be completely installed and fully operational by 30 September 1995. There is no migration plan for the CN/CMS, although the system employs the Army Common Operating Environment to the maximum extent possible. CN/CMS will be the target system.

Cover and Deception System (CADS). CADS provides a ship or battlefield deployable, modularized, communications system capable of supporting C3 countermeasures (C3CM) and operational deception by mimicking own force or opposing force communications, or by impeding enemy use of the electromagnetic spectrum by the use of intrusion or jamming techniques. The CADS function must be adaptable to the full spectrum of host platforms and a wide variety of operational environments. To meet this requirement, the system must be modularized.

Crisis Action Team Aircraft/Aircrew Report (CATREP). CATREP provides current information to Headquarters AMC and the Numbered Air Force Crisis Action Teams on the commitment and availability of unit aircraft and crews at base station Crisis Management Subsystem (CMSS). CMSS will provide crisis/contingency planning, decision-making and execution management for Military Sealift Command (MSC).

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Critical Intelligence Communications (CRITICOMM). CRITICOMM facilities are managed by NSA and operated and maintained by the military departments. Its principal function is the transmission and delivery of CRITIC message traffic. A CRITIC is a message containing critical information concerning foreign situations of developments which affect the security or national interests of the US. The secondary function is to support the SCI traffic requirements of the intelligence community as part of the Defense Special Security Communications System (DSSCS). CRITICOM terminals can communicate with SPINTCOMM network on a worldwide basis.

Data Administration (DATA ADMIN). Data administration is the command program charged with management and control of AMC data as a corporate asset to promote interoperability of AMC systems and effective data sharing across those systems. The AMC–Data Repository uses the COTS product Open Repository developed by the InfoSpan corporation. Open Repository is the only FIPS 156 compliant repository that is commercially available.

Defense Automated Warning System (DAWS). DAWS is an Intelligence Operations Center automated support tool designed to help the watch stander perform faster and more reliably.

Defense Automatic Addressing System (DAAS). DAAS, a Defense Logistics Agency system, routes and records Military Standard Requisition and Issue Procedures transactions between the retail and wholesale supply activities within the wholesale supply activities and Military Standard Transportation and Movement Procedures transportation transactions.

Defense Commercial Telecommunications Network (DCTN). The purpose of the DCTN is to provide leased switched voice, data, and video teleconferencing throughout the US. The network is managed by DISA, currently serves over 250 locations, and is designed to minimize costs. It is evolving as an integral element of the Defense Switched Network (DSN).

Defense Communications System (DCS). The DCS is a worldwide transmission system comprised of US-government owned and operated communications facilities and circuits leased from commercial telecommunications carriers. The government owned portion includes all long-haul assets of the Army, Navy, and Air Force except those devoted to tactical communications. The types of transmission media include LOS radio, over-the-horizon (OTH) tropospheric scatter radio, HF radio, satellites, and cable. Most government owned facilities are located outside the US. The DCS transmission system interconnects common user switched networks of the DCS (DMS/AUTODIN, DSN/AUTOVON, and DDN) and provides full period dedicated circuits to support command and control requirements between the National Command Authority (NCA), the Joint Chiefs of Staff (JCS), and Unified and Specified commands. Other government agencies are provided service when spare capacity exits. The DCS provides high capacity, high quality, reliable, and

secure circuits capable of handling all modes of service for the user, with transmission rates of 64 kbps for voice and up to 512 kbps for data. Typically, two or more gateways provide worldwide access from each theater. Wide band transmission systems provide multi-channel capacities ranging from 24 to 576 channels. DCS interconnect/access points are provided to all or most major headquarters and bases and to tactical forces down to and including corps/wing echelon. Ground Mobile Forces (GMF) access the DCS through Echelons Above Corps Communications (EAC COMM) equipment which connects to the DCS via terrestrial interfaces or DCS HF entry stations or through Ground Mobile Forces Satellite Communications (GMFSC) satellite links which down link to GMF gateways at selected Defense Satellite Communications System (DSCS) earth stations worldwide.

Defense Communications System (DCS) High Frequency (HF) Entry Stations. The DCS HF entry stations are eleven Service operated HF communications stations worldwide designated and equipped for interfacing tactical HF systems into the DCS. DCS HF Entry Stations serving the USEUCOM AOR are: Naval Telecommunications and Computers Station (NTCS) Norfolk, VA; Andrews AFB, MD; MacDill AFB, Fl; Croughton, UK; Incirlik AB, TK; Rota, SP; and Pirmasens, GE. The DCS HF Entry Station Improvement Program adds the HF Standard Entry Modem and HF/AUTODIN Interface Device and adds 1 to 3 trunks to eleven existing stations (from 2 each). It also adds six new fixed stations: Thurso, Sigonella, Diego Garcia, Ascension Island, Puerto Rico, and Guam.

Defense Communications System (DCS) Mediterranean Improvement Program (DMIP). The DMIP provides enhanced DCS support within the Mediterranean area. DMIP Phase I in the eastern Mediterranean, configured commercial connectivity in Turkey. DMIP was considered complete in January 1993. DMIP Phase II has been renamed the DCS Spain/Italy Reconfiguration (DSIR).

Defense Communications System (DCS) Spain/Italy Reconfiguration (DSIR). DSIR is the follow on to the DCS Mediterranean Improvement Program (DMIP). For Spain and Italy, DSIR includes installation of integrated digital network exchange (IDNX) modems, upgrades of current IDNX multiplexers, leased service activations, DSCS link activations, and US Government owned terrestrial links with IDNX activations.

Defense Data Network (DDN). The DDN is a wide-area network that provides long-haul data communications service for DOD authorized users. The network is currently segmented into the unclassified MILNET and three classified network: DSNET1 for Secret-level traffic; DSNET 2 for Top Secret-level traffic; and DSNET3 for TS/SCI-level traffic. Through implementation of BLACKER Host-to-host encryption technology. The DDN provides the DOD with a survivable and secure, worldwide packet-switching service for critical data (query/response, interactive, and bulk) communications. DDN satisfies the long-haul communications needs of the DOD data communications users, provides integral support to mission essential C2, and also serves DOD intelligence, logistical, operational, and administrative requirements. The

DDN will enhance the connectivity of all subscribers attached to the system, including WWMCCS Information Network (WIN), DOD Intelligence Information System (DODIIS), Defense Message System (DMS), and other systems currently using a dedicated backbone or AUTODIN. All DDN requirements are planned to be merged into the Defense Information Systems Network (DISN) in FY96.

Defense Information Infrastructure (DII). The DII is that of a seamless, global, standards based end-to-end architecture that provides assured, flexible and affordable information services to the warrior. The DII encompasses information transfer and processing resources, including information and data storage, manipulation, retrieval, and display. More specifically, the DII is the shared or interconnected system of computers, communications, data, applications, security, people, training and other support structure, serving the DOD's local and worldwide information needs.

Defense Information Systems Network (DISN). When fully implemented, DISN will combine the former Defense Communications System (DCS) networks of the existing DDN, and the Defense Switched Network (DSN) with the Defense Message System (DMS), as well as leased commercial connectivity into a new, common- user multi-media network. The DDN and DSN were established separately to perform different functions, such as transferring data between computer terminals and providing telecommunications for the DOD. The new global network will combine computer data and voice networks, and incorporate communications satellites, microwave relay as well as ordinary communications trunking cables. The network will automatically route the traffic via the most efficient path, regardless of the medium, i.e., record message, voice, data, video, etc. The DISN is being managed by DISA.

Defense Information System Security Program (DISSP). The DISSP was initiated at the request of the ASD(C4I) with eight objectives which involve: Security policy; Architecture; Standards and protocols; Accreditation procedures; Technology; Transition planning; Organizational improvement; and Products and services availability. It is concerned with the transition of existing C4I systems, and in the development of new systems for the Defense Information System.

Defense Integrated Secure Network (DISNET). DISNET is the name given to the single, integrated network which will result from combining DSNET 1 (Secret level), DSNET 2 (Top Secret level), and DSNET 3 (SCI level) networks when multi-level security systems have been fully implemented. DISNET will ultimately be subsumed by DISN.

Defense Logistics Agency Corporate Network (DCN). The DCN is a subset of the DISN-NT consolidation effort. It is CONUS-wide network consisting of 55 nodes and is used for passing logistics administration traffic. Long-haul connectivity for the network is provided through leased facilities. A variety of element management systems are used to manage the network. The DCN is connected to the MILNET at 14 locations.

Defense Medical Regulating Information System (DMRIS). DMRIS is an automated system which aids in regulating patients into the hospital system. It automates hospital bed allocations based on bed availability, patient condition and diagnosis. The system is used to track requests for patient beds and inter-hospital transfer requirements requiring AMC airlift and to maintain clinical and demographic patient information. It will be integrated with APES and the Global Transportation Network.

Defense Message System (DMS). The DMS consists of all hardware, software, procedures, standards, facilities, and personnel used to exchange messages electronically between organizations and individuals in the DOD. The current subsystems of the DMS are the AUTODIN (including base level support systems) and electronic mail on the DOD Internet. The DMS also includes interfaces for tactical and allied systems, but does not include those systems. DMS will provide responsive and reliable exchange of messages electronically among organizations and individuals within the DOD, other Federal Government Agencies, and selected allied and foreign subscribers authorized by DOD. The current DMS consists of the organizational messaging service provided by AUTODIN and individual electronic mail messaging service (E-mail) provided via DDN. DMS will transition to messaging service based on international standards. When fully implemented, DMS will provide seamless writer-to-reader messaging service at a cost and staffing level that is significantly reduced as compared to today's services.

Defense Meteorological Satellite Program (DMSP). The DMSP provides an environmental satellite with sensors and support elements to collect and disseminate weather information, worldwide, to operational military service commanders. The DMSP Upgrade will receive weather satellite pictures from DMSP, METEOSAT, and NOAA satellites. The upgrade automates picture transmission over the Secondary Imagery Dissemination System (SIDS) circuits and eventually over the Automated Weather Distribution Service (AWDS).

Defense Red Switch Network (DRSN). The DRSN is a program to install and connect Red Voice switches at key command and communications nodal locations. The DRSN provides worldwide service, including conferencing and linking with other secure voice network users, to users at the National Military Command Center (NMCC), the NMCC Site R, and Unified command centers. Each Red Switch consists of a central PBX-type exchange that contains interfaces to numerous secure voice systems, including tactical systems. The switch provides connectivity for a community of "red" phones that send unencrypted signals over a shielded cable within a physically protected area for processing and encryption at the Red Switch. A dedicated T-1 carrier trunking network interconnects individual Red Switches which, in turn, can accommodate 32 kbps subscriber circuits. The DRSN is one component of the Secure Voice System (SVS) architecture.

Defense Satellite Communication System (DSCS). The DSCS provides the transmission backbone of high capacity command and control, intelligence and multichannel communications service. The DSCS provides critical connectivity for the NCA/JCS, Unified/Specified Commands, DOD Agencies, Department of State, and (by resource sharing agreements) the UK and NATO. The DSCS directly supports the Worldwide Military Command and Control System (WWMCCS) and Ground Mobile Force Satellite Communications (GMFSC) elements.

Defense Simulation Internet (DSI). The DSI is a communications network intended to support distributed simulations. DSI links organizations such as simulations centers, training facilities, defense laboratories, war fighting CINCs, and the Joint Staff. At maturity, DSI will facilitate multi-level, multi-CINC distributed exercises and war games. DSI is limited to fixed sites and is not intended as an operational C2 system. However, some of its capabilities, like video conferencing between CINCs and the Joint Staff, may be used to support war fighting operations. The DSI program is sponsored by the Defense Modeling and Simulations Office.

Defense Switched Network (DSN). The DSN will provide worldwide, state-of-the-art, cost effective, interbase telecommunications voice, data, and video service. It is designed to support critical users effectively during peacetime, crisis, and non-nuclear war, and to facilitate reconstruction of communications in a post-attack environment. The objective of the DSN is to evolve into the DISN, which will integrate voice, data, and video capabilities in a common user system to accommodate changing requirements, emerging technology, and improve pricing in the marketplace.

DSN Remotely Programmable Conference Arranger (DRPCA). The DRPCA, an all-digital modular conferencing bridge, allows AT&T to continue digitalization plans for network and special service equipment. Utilization of new digital products provide improved service through reduced maintenance requirements. The DRPCA conferencing bridges replaced the ARPCA analog bridges located at Williamstown, Kentucky and Lyons, Nebraska. The NMCC has two PCs that are connected to each respective conference bridge. The PC conference controllers allow the operator to configure DSN preset conferences and to monitor the status of conferences.

Defense Transportation Tracking System (DTTS). DTTS, a DOD system, is an automated data processing based system designed to track and monitor shipments in the Continental US (CONUS) from consignor to consignee with increased surveillance and security while in transit. It uses two-way digital communications and computer technology with commercial vehicles to track geographical locations and communicate with ammunition trucks in CONUS. DTTS tracks each CONUS truck shipment of Class I explosives. The trip start, in transit location, and trip end are recorded. DTTS is comprised of four segments: Data Entry Call-In, Computer Dial-In, Vehicle Call-In, and Satellite Tracking.

Demand Assigned Multiple Access)/(Miniature Demand Assigned Multiple Access (DAMA/Mini-DAMA). DAMA was developed to provide increased capacity and flexibility with the Navy's UHF SATCOM program. The UHF DAMA subsystem employs time division multiple access (TDMA) to multiple voice, Teletype (TTY, data, and various Fleet SATCOM automated information exchange subsystems onto a single UHF 25 kHz satellite channel. Mini-DAMA is the second phase of UHF DAMA development that will provide a miniaturized version of the system's multiplexer for installation in ships, submarines, aircraft, and portable shelters. Mini-DAMA equipment will perform the same functions as the UHF DAMA equipment, i.e., take several baseband signals, use TDMA techniques to combine/decombine and organize them, and receive or initiate RF burst transmissions using internal or external RF capabilities.

Department of the Army Movement Management System-Redesign (DAMMS-R). DAMMS-R provides an automated information processing capability in support of cargo movements, mode asset management, and unit movements within a theater of operations (TOPNS). It provides movement managers, highway regulators and mode operators with timely and accurate information on what cargo must be moved, when it must be moved, where it will moved, who will move it, and in what priority it will be moved. The system functions will support the readiness mission in garrison and during training exercises to ensure rapid transition from peace to war. DAMMS-R will be the standard Army theater transportation management system, encompassing all levels of movements management and all modes of transport less pipeline. When fully developed, it will be capable of providing each theater and the operating elements there in a distributed interactive transportation management information processing system with go-to-war capabilities.

Department of the Army Standard Port System-Enhanced (DASPS-E). DASPS-E, a Department of The Army system, records cargo arrival, staging, and out loading information for Outside CONUS (OCONUS) ports. DASP-E will be replaced by the Worldwide Port System.

Deployable Consolidated Aerial Port Subsystem (DCAPS). DCAPS is the AMC deployable version of CAPS. Deployment, employment, and Mobilization Status System (DEMSTAT). DEMSTAT provides a command and control management tool to meet crisis situations requiring reserve component mobilization and/or the sub-Army units. It is capable of using the OPLAN in Time-Phased Force and Deployment Data (TPFDD) format and allows for the development of a special troop list.

Deployable Intelligence Communications Support (DICS). The DICS is the field extension of the USACOM Intelligence Network. It is a deployable intelligence workstation and, depending on operational needs, can be configured to meet several applications. One JDISS configuration operates at the collateral level, and another at a compartmented (SCI) level. Selected terminals provide an imagery transmission capability, offering a standardized terminal to replace other command

systems such as PORTS and FIST. The Joint Deployable Intelligence Support System (JDISS) will become the principal workstation used by USACOM and other commands to disseminate data, imagery, and facsimile intelligence to the field.

Deployment Tracing System (DTS). DTS will track aircraft visibility and develop organic schedules for AMC.

Digital European Backbone (DEB). DEB refers to the DCS digital microwave system in Europe. DEB upgraded and converted the previous analog line of sight microwave and selected troposcatter links to bulk encrypted, digital transmission. Typically, DEB links provide a transmission capacity of 25 mbps and 400 channels between nodes. It provides communications security up to TOP SECRET/SIOP-ESI.

Digital Wideband Transmission System (DWTS). The AN/MRC-142 is a High Mobility Multipurpose Wheeled Vehicle (HMMWV)-mounted multiplexer (MUD) radio terminal set which will operate from fixed positions to provide voice and data communications over LOS distances up to 35 miles. The radio terminal will operate in the UHF (300-3000 MHz) band, will provide two duplex channels, and will be able to handle digital data rates of 128, 256, and 512 kbps.

Diplomatic Telecommunications Service (DTS). The DTS provides record/data service between the State Department in Wash, DC and its foreign missions. DTS circuits predominantly ride DCS transmission systems and leased commercial links. These include the DTS satellite network SKYLINK, which uses approximately ten percent of the total power/bandwidth of the DSCS with DTS owned and operated earth terminals.

Direct Broadcast Satellite (DBS). DBS will, using VCR sized terminals with 18" antennas, satisfy warfighter' one-way (receive only), high capacity data requirements (such as imagery, ATO, and tomahawk MDU dissemination). ASD (C3I) and Joint Staff J6 are working to consolidate DBS requirements, develop a CONOPS, and initiate DBS program with goal of establishing a global DBS network as soon as possible.

DOD Intelligence Information System (DODIIS). DODIIS represents a worldwide intercomputer network linking intelligence data handling systems. These computer based information systems support the collection, production, and dissemination of various defense intelligence products. The system also supports the management of Defense intelligence assets throughout the world and provides a large number of automated information systems to process and catalog the extensive intelligence holdings.

Dual Mode IFF. The Dual Mode IFF is required to provide the F-14 and F/A-18 aircraft with a beyond visual range (BVR) capability to identify both friendly and hostile aircraft. Currently, the F-14 and F/A-18 each have half of the BVR capability. The F-14 has an IFF interrogation system which only provides identification of friendly aircraft and the F/A-18 has a Non-cooperative Target Recognition (NCTR) system which can only identify hostile aircraft. There is no system available

to provide identification of hostile aircraft in the F-14 and friendly aircraft in the F/A-18. To enable full use of BVR capabilities of the weapons systems in both aircraft under the conditions of the Rules of Engagement (ROE), a second source of identification is required. All F-14s require a NCTR system like the F/A-18 or F-15 as a second source, while the F/A-18 requires installation of a combined interrogator/transponder (CIT) system similar to that slated for the F/A-18 E/F.

Dynamic Analysis and Replanning Tool (DART). DART provides USTRANSCOM with the ability to analyze a deployment flow rapidly and replant as necessary.

Early Pentagon Connectivity (EPC). EPC is a survivable and secure voice system providing communications between NORAD, USSTRATCOM and the NMCC. It is a full-duplex 2.4 Kbps voice circuit which uses DSCS Channel One (ECCM Channel). The system is HEMP protected. EPC is available at several console positions (ICC-I and MLP-2 phones) in the USSTRATCOM Command Center. Connectivity is via the Red Switch.

Echelons Above Corps-Communications (EAC-COMM). EAC COMM (formerly TRI-TAC) is a joint service program to develop and field tactical multi channel and switched communications equipment. It is the Army C2 system for EAC communications, and provides interfaces to systems corps and below. It includes transmission, switching, control, and security equipment. It provides automated telephone and message switching and automatic fault isolation. There are four major area nodes for EAC battalions in Europe. Selected EAC nodes can interconnect with Mobile Subscriber Equipment (MSE) for corps level interface, and selected EAC nodes can interconnect with other Service systems and the DCS.

Electronic Key Management System (EKMS). Incorporated in EKMS are new Joint C4I for the Warrior concepts, technical capabilities developed for the strategic level Enhanced Key Management System and evolving security disciplines under the Defense Wide Information Systems Security Program security architectures. Once available, EKMS will provide technical solutions for the following current COMSEC problems: 1) vulnerability of hard copy key; 2) projections of increased keying material demands; 3) development of new COMSEC devices and keying materials requiring automated key management; and 4) increasing difficulties experienced in coordinating joint COMSEC complicated by force reductions.

Emergency Shipping Information System (EMSIS). EMSIS supports emergency shipping operations of the US Shipping Authority and the North Atlantic Treaty Organization Defense Shipping Authority. It processes National Security Agency requests for allocation of shipping capacity to relevant ships and allocates ships to MSC for strategic sea lift.

Enhanced Airlift Reporting for Logistics and Operations (EARLO). This program is a computer network which provides for the timely and accurate reporting of aircraft, aircrew, and flight information.

Enhanced Frequency Resource Record System (EFRRS). The EFRRS is a JCS sponsored system that provides frequency managers, at all levels, an ability to manage day to day as well as special case frequency requirements. It makes available specific information such as desired frequencies, details of transmitters and receivers, locations, time frames and assignments. The Electromagnetic Compatibility Analysis Center is currently analyzing the feasibility of integrating EFRRS with the Joint Spectrum Management System JSMS to provide a single system capable of interchanging, holding, analyzing, and disseminating spectrum management data.

Enhanced Manpack Terminal (EMUT). EMUT is a small lightweight line of sight UHF satellite transceiver capable of operating at all ranges within the satellite's footprint with cryptographic and DAMA operations capabilities for voice and data communications.

Enhanced Position Location Reporting System (EPLRS). The EPLRS is designed to provide a reliable data communications system to support tactical operations of Army air and ground units. It provides mobile battlefield environments with: 1) automatic near real time position computation; 2) position reporting; 3) friendly identification; 4) navigation; 5) automatic relay and network management; and 6) direct, user to user communications. The system links high priority elements within each combat functional area at primarily Army division echelon, and provides communications between these areas. Links are implemented through use of automatic integral relays with interfaces to host equipment at each end. EPLRS is a TDMA system using a frequency hopping, spread spectrum waveform in the UHF band. It incorporates internal COMSEC devices and has an Over-the-Air Rekeying (OTAR) capability. EPLRS provides position location, identification, and reporting information to both the user and to their higher headquarters. This information will greatly enhance the C2 of tactical units by providing commanders with the location of friendly units, a dynamic representation of the Forward Line of Troops (FLOT) and abbreviated situation reports (SITREPs). EPLRS equipped units can acquire the location of the tactical units equipped with PLRS and the location of their C2 facilities. EPLRS is part of the Army Data Distribution System (ADDS), an integrated C3 architecture for the modern battlefield.

ENTERPRISE. The purpose of the Army Enterprise is to provide a view of the information needs of the Army as a whole: a) as a fighting force, a component of a joint or combined force, b) the support and sustainment of that force, and c) the organizational, business, and administrative structure that supports all aspects of the Army.

European Theater High Capacity Intelligence Communications System (ETHICS). ETHICS is a European subset of the Joint Worldwide Intelligence Communications System (JWICS). It will augment DOD common user systems where such

systems lack either the capability or capacity to satisfy specific Intelligence Community requirements. It will consist of both fixed and deployable communications nodes co-located with the principal theater intelligence and Command and Control (C2) elements. It will include secure voice teleconferencing capability between the theater intelligence producers who will be in the United Kingdom and the users of their products who will be, for the most part, on the Continent or, in some cases, deployed with a Joint/Combined Task Force.

EW Control System (EWCS). The EWCS processes and integrates EW data received from unit resources for timely support to the CO/TAO. It contains a parametric database, supports EW-Single Source Integration (SSI), and enables timely unit EW resource management.

EW Coordination Module (EWCM). EWCM, a subsystem of the NTCS-A program, is designed to support tactical assessment, planning, direction, and redirection of BF/BG EW and C3CM assets. The EWCM has separate GENSER and SCI processors which are integrated via CIDs between the NCCS buses.

Federal Cataloging Data System (FEDLOG). A Defense Logistics Agency (DLA) sponsored system used by the Marine Corps as a Federal cataloging data system.

Federal Telecommunications System (FTS-2000). FTS 2000 provides a modern network with voice, data, and video services. It offers a wide variety of services using state-of-the-art digital, fiber optic, and networking technology. The AT&T portion of the system serves approximately 800,000 government personnel. Including US Sprint support, the system serves about 1.3 million users in 3500 locations. Switched data service allows information from host and person computers, facsimile machines, allowing fast data transfer when traffic is not high enough to justify a dedicated line. Packet switched service offers a way of transmitting low speed data that often occurs in peaks.

Financial Management Information System (FMIS). FMIS is a financial management system which provides MSC with a comprehensive, integrated, command-wide set of governmental financial applications. FMIS is designed to assist in supporting the fiscal and legal requirements and also the control and management of the financial requirements of MSC. FMIS will be replaced by the Transportation Financial Management System.

Financial Management System (FMS). FMS is MTMC's Command Army Industrial Fund and appropriated fund accounting system which provides management information to MTMC managers in CONUS and OCONUS. It performs budget, cost accounting, billing, disbursements, and resource management activities. FMS will be replaced by the Transportation Financial Management System.

Fixed Submarine Broadcast System (FSBS). The FSBS is a secure, one-way, record communications system from fixed shore locations to SSBNs. The primary FSBS means of communications is VERDIN, which is a multichannel VLF secure broadcast processing system. A single transmitter may support transmission of up to four channels. The secondary mode is LF and HF single channel FSK. FSBS/VLF/LF/HF locations are at Jim Creek, WA; Lualualei, HI; H.E. Holt, AS; Cutler, ME; and Keflavik, Iceland. A VLF site is located at Annapolis, MD (projected to be deactivated in FY 95). HF sites are at Moron, SP, and Sigonella, IT. It is used for force direction, command and control, operational intelligence, day-to-day administration and morale and welfare. It is also a subsystem within the JCS VLF/LF communications system. By seizing ALFA components of the Submarine Broadcast net through INMATES/AUTODIN, the CJCS can transmit EAMs directly to the nuclear forces.

Fleet Broadcast System (FBS). The FBS is the primary means for communicating message traffic to naval ships at sea. The broadcast consists of 16 channels of encrypted 75 baud teletypewriter data which is typically transmitted near simultaneously over LF, HF, and UHF SATCOM media. Various channels of the broadcast are designated for particular operational communities. Ships are expected to copy a set of channels, usually numbering four, rather than monitor the entire 16 channel broadcast. Naval Computer and Telecommunications Area Master Stations (NCTAMS) generate the broadcast for their area of responsibility using the Naval Communications Processing and Routing System (NAVCOMPARS) equipment which automates the dissemination process. The NCTAMS also serve as broadcast injection points for Fleet Satellite Communications (FLTSATCOM) transmissions. At selected shore stations, Fleet Broadcast message traffic is retransmitted from HF and/or LF transmitters. The High Speed Fleet Broadcast (HSFB) Program offers the capability to reallocate available information throughput capacity among users in response to changing tactical environments and the ability to handle traffic quantity and quality demands imposed by high speed automation subsystems.

Fleet Flash Net (FFN). The FFN is a network which provides C2 for tactical naval forces. It is used by major fleet commanders and authorized subscribers.

Fleet Marine Force End-User Computing Equipment/Downsized End-User Computing Equipment (FMF EUCE/ DEUCE). The FMF EUCE program will replace Automatic Data Processing Equipment (ADPE) FMF devices and numerous non-standard computers in the field with ruggedized, TEMPEST certified microcomputers. The program encompasses source data automation, personal computer, automated workstation, and word processing equipment. Users will be provided with a basic configuration and, where warranted, the ability to select a variety of optional hardware and software.

Fleet Mobile Operational Command Center (FMOCC). The FMOCC was developed to provide C2 connectivity with the Joint Component Commanders ashore as well as with Naval forces afloat. It will provide the Naval Component Commander ashore with a complete range of C3I features that has been designed to be the equal or greater than what would be available afloat. The FMOCC is normally housed in seven portable vans, and one or more command/operations center expandable shelters to support the commander and his staff; all can normally be airlifted in nine, C-130 aircraft or two C-5 aircraft. FMOCC provides communications (SHF, UHF, HF, commercial phone, facsimile (FAX), STU-III (STel), International Maritime Satellite (INMARSAT); intelligence (Naval Intelligence Processing System (NIPS), JDISS, Cable News Network (CNN)); imagery (JDISS, Fleet Imagery Support Terminal (FIST)); tactical strike (Joint Operational Tactical System (JOTS), JTIDS, Link 11, Mobile Universal Link Translator System (MULTS), Tactical Information Management System (TIMS), Tactical Air Mission Planning system (TAMPS)); and ATO (CTAPS) capability for the Navy Component Commander Ashore.

Fleet Satellite Broadcast System (FSBS). The FSBS provides the principal record and message distribution means to the fleet. It has replaced the HF radio broadcast as the primary means. It supports primarily fleet units and tactical forces (USMC) ashore.

Fleet Satellite Communications System (FLTSATCOM). FLTSATCOM is a system of three US Navy UHF satellites in equatorial geosynchronous orbit. The system provides virtually worldwide connectivity between 70 degrees N and 70 degrees S for a variety of long haul, point to point, broadcast, and netted communication links among mobile and shore units. Each FLTSATCOM satellite has the capability to relay communications on 23 separate UHF channels, ten 25 Khz channels, twelve 5 Khz channels, and one 500 Khz channel for each satellite. The ten 25 Khz channels have been dedicated for Navy use. The twelve 5 Khz channels are part of the Air Force Satellite Communications (AFSATCOM) package. The 500 Khz channel may be used by either the Navy or Air Force depending on satellite location.

Fleet Submarine Broadcast System (FSBS). The FSBS is a VLF and LF communications network providing a means for the two submarine Broadcast Control Authorities to transmit messages to deeply submerged submarines. The FSBS complements the Submarine Satellite Information Exchange System (SSIXS), providing an alternative transmission path.

Follow-On Tactical Reconnaissance System (FOTRS). The FOTRS program is an umbrella reconnaissance concept that includes two projects, the ATARS and the JSIPS. This FOTRS combination will provide a near-real-time tactical imagery capability; the ATARS common-sensor suite will be carried on the USN F/A-18C, USMC F/A-18D, USAF F-16, and unmanned aerial vehicles-medium range (UAV-MR) while the JSIPS ground station supports the ATARS imagery sensors and is capable of receiving, processing, and exploiting the digital data from either the data link or tape recordings. Interservice program benefits will be derived through the use of equipment and technology being developed for the FOTRS program.

Force Augmentation Planning and Execution System (FAPES). FAPES is used in the areas of manpower and mobilization analysis for joint operations. It is primarily a retrieval and reporting system. The FAPES is a component of JOPES/TIP application programs. It is accessible via TIP workstations along with the Dynamic Analysis and Replanning Tool, (DART), Logistics Sustainment Analysis and Feasibility Estimator (LOGSAFE), and the Joint Flow and Analysis System for Transportation (JFAST).

Force Level Execution (FLEX). The system will provide additional automation to the combat operations division for the command and control system architecture in ACC, USAFE, and PACAF to assist in near– real–time monitoring and execution of the air tasking order (ATO) based on rapidly changing battlefield conditions. FLEX will have the capability to support planning, monitoring, assessment, targeting, and plan modification.

Forward Area Air Defense Command/Control And Intelligence System (FAADC2I). Part of the Army Tactical Command and Control System (ATCCS) that integrates all forward areas' air defenses against enemy aircraft and airspace management. FAAD C2 is being developed to coordinate the Army's new air defense system (formerly Short Range Air Defense (SHORAD). It will provide connectivity for all of the FAAD systems and will use a mixture of off-the-shelf ground sensors and both new and existing aerial sensors including AWACS. The FAAD C2 system consists of processors and displays, software and communications equipment to meet the C2 and targeting needs of FAAD battalions and separate batteries. This system will also fulfill the functional requirements of the air defense artillery component of the ATCCS and will interoperate with joint and allied High-to-Medium Altitude Air Defense (HIMAD) C2 systems.

Future Command And Control Vehicle (FC2V). The FC2V is a USAREUR prototype effort supporting the Army's XM4 Command and Control Vehicle (C2V), the scheduled replacement for the M577 Command Post Carrier. Unlike the M577, the C2V operates with the staff seated at workstations in the vehicle. Also, unlike the traditional command post where junior soldiers operate the radios and computers while the decision makers reflect at the map, the C2V concept has the principle staff operatives and decision makers electronically tied in to each other and operating the automation systems. This is a radical concept, allowing the vehicle to operate stationary or on the move without the need for setting up a large command post, thus being as mobile as the forces it controls.

Garrison C3I Improvements (USSOCOM HQ). This program extends USSOCOM communications to forward-located SOF elements beyond the SOCs to provide the SOF-unique C3I to support mission planning and execution. This program extends SOCRATES to the locations identified in the SOFPARS ORD, supports the SOF intelligence vehicle, and provides SCAMPI connectivity to the centralized SOFPARS that will be used to train personnel in SOF mission planning. The program also funds the preplanned product improvement of the tactical gateways to provide a full T1-bandwidth.

General Service Intelligence Traffic (GENSER). GENSER traffic is classified traffic which does not require the added special handling normally associated with Special Compartmented Information (SCI), which requires additional safeguards in both handling and dissemination

Geostationary Operational And Environmental Satellite (GOES). GOES is the American geosynchronous satellite imagery system. USAFE receives a portion of the GOES imagery via the European-owned METEOSAT geosynchronous satellites. It interfaces with the DMSP Mark IV vans, where GOES data is entered into the USAFE Secondary Imagery Dissemination System (SIDS) network.

Global Command and Control System (GCCS). GCCS is a new initiative, intended to furnish warfighters at all levels with needed connectivity, rapid access, flexibility, and simplicity in operations for comprehensive, interoperable, global command and control capability anytime and anywhere. GCCS is intended to improve on WWMCCS capabilities and move data within the C4I for the Warrior program.

Global Decision Support System (GDSS). Global Decision Support System (GDSS) supports the air mobility system. Through automated interfaces, GDSS receives and sends mission schedule and execution data to and from various automated systems either automatically or semi– automatically. An example: Air Mobility Command Deployment Analysis System (ADANS) pulls requirements from the Joint Operation Planning and Execution System (JOPES). Operations are planned, scheduled and pushed to GDSS for execution. Depending on system needs, GDSS shares both schedule and execution data with the following automated systems: ADANS, Command and Control Information Processing System (C2IPS), JOPES (GCCS), and Global Transportation Network (GTN/GCCS).

Global High Frequency System (GHFS). HF communications of the USAF GHFS, formerly the USAFs Global Command and Control System (GCCS), provide ground/air/ground and point-to-point, long-range, voice communications for USCINCSTRAT to control strategic forces worldwide. The primary missions are to support strategic reconnaissance and exercise command and control of the strategic forces across the conflict spectrum. It also is used extensively for day-to-day aircraft reporting and point-to-point communications. The daily use of the total HF/SSB (single sideband) system in support of training exercises and position reporting has established the reliability and effectiveness of this system in a peacetime environment. It is also a valuable combat asset for both nuclear and conventional operations.

Global Positioning System (GPS). The Global Positioning System (GPS) is a space-based radio positioning and navigation system that will provide extremely accurate three-dimensional position, velocity, and system time to suitably equipped users anywhere on or near the earth. In one proposed configuration, six satellites will transmit a composite signal at two L-Band frequencies consisting of a protected navigation signal and a clear navigation signal. The signals contain data

such as satellite position, atmospheric propagation correction data, and satellite clock bias information. The system is passive and, therefore, unsaturable. The navigation accuracies are unaffected by weather phenomena and the pseudo random noise signal structure provides a degree of security and resistance to jamming. The GPS consists of three segments: space segment, control segment, and user segment.

Global Transportation Network (GTN). GTN is the automate support necessary to enable USTRANSCOM and its Transportation Component Commands (TCCs) to provide global transportation management. It provides the integrated transportation data and systems necessary to accomplish global transportation planning, C2, and in transit visibility during peace and war. The major subsystems of GTN include Patient Movements, Current Operations, Future Operations and Intransit Visibility (ITV). AMP and the US Transportation Command (USTRANSCOM) Regulating and C2 Evacuation System (TRAC2ES) are two separate systems that will be integrated into GTN to provide Future Operations and Patient Movement capabilities. GTN consists of hardware, software, telecommunications and procedures which allows efficient access to and transfer of information among multiple geographically dispersed transportation data bases. It supports the entire spectrum of transportation functions.

Government Emergency Telecommunications Service (GETS). GETS is a new service offered by the Office of the Manager, National Communications System (OMNCS), to met National Security and Emergency Preparedness (NS/EP) requirements for the use of public, defense, or Federal telephone networks by government départments, agencies, and other authorized users. GETS provides authorized NS/EP users with nationwide and international switched voice and low-speed data telecommunications under a full range of emergency conditions, including nuclear war, using surviving assets of the Public Switched Network. GETS provides emergency access and specialized processing in local and long distance telephone networks. GETS is accessed through a universal access number 1+710+NXX-XXXX using common telephone equipment such as a standard desk set, STU III, facsimile, modem or cellular phone. A personal identification number is required for access. Government-leased networks which support the GETS include the FTS-2000 and the DISN.

Granite Sentry. Granite Sentry Upgrade Program FOC will incorporate CSSR and AUTODIN interfaces, Operations Plan (OPLAN) functionality, and the capability to produce Air Correlation Center Output Message Set (CCOMS) messages.

Ground-Based Sensor (GBS). The GBS is an NDI system capable of providing search and track functions against fixed and rotary wing aircraft. The GBS is a part of the FAAD system and there will be six GBS located in the Air Defense Battalion of all divisions. Each GBS will be netted with the C2I network to report those targets it is tracking. Each GBS will incorporate the capability to provide the IFF function to identify friendly aircraft and will have NCTR technology for passive identification of friendly and hostile aircraft.

Ground Mobile Forces (GMF) Interoperability Program. This program addresses the lack of interoperability between the Army and the Air Force SHF GMF terminals, which is a result of a difference in baseband and bulk encryption components. The baseband improvement modification to the AN/TSC-85A and the AN/TSC-93A and the AJ control modem modification to all GMF terminals, control centers, and gateways will result in increased interoperability.

Ground Mobile Forces Satellite Communications (GMFSC). GMFSC is the primary space-based multi channel communications capability available for deployed tactical forces on a worldwide basis. Employing mobile SHF terminals and the DSCS satellite constellation along with NATO SATCOM IV and the British Skynet satellites on a shared basis, the GMF system furnishes long haul transmission media for meeting both a deployed force's internal communications needs as well as external connectivity between tactical commands of the Army, Marine Corps, and the Air Force. GMFSC accesses the DCS through GMF SHF Gateways at specified DSCS earth stations.

Group Operational Passenger System (GOPAX). GOPAX, a MTMC system, records requests for movement of personnel in groups greater than 20 and records the resultant contract data.

GUARDRAIL Airborne Tactical Intelligence System. GUARDRAIL is an Army airborne tactical SIGINT reconnaissance program use to provide near real time tactical intelligence to the warrior at the Army corps level on the battlefield. The GUARDRAIL is capable of near all-weather, 24-hour operations to perform both ELINT and COMINT missions. The platform is a Beechcraft 200 series twin turbo-prop aircraft, the RC-12H.

Hand-held Intra-Team Radio (ITR). Procurement of hand-held intra-team radios will replace the AN/PRC-68, MX-300, and Sabre family of radios. It provides NSW forces with a secure, programmable, waterproof, SOF standard intra-team radio.

HAVE QUICK (UHF Radio System). HAVE QUICK is an anti-jamming system for airborne and ground-to-air UHF radios. It is installed as an appliqué which converts existing radios to frequency hopping capable radios. The current standard is HAVE QUICK II (slow hopping rate). The HAVE QUICK IIA fast hopping mode (SATURN) is a potential NATO standard. The HAVE QUICK waveform will be usable in the Navy's ARC-210 Combo Radio.

HAVE STARE. HAVE STARE is an X-band, large aperture, high resolution, high power imaging radar being constructed at Vandenberg AFB, CA. The system is scheduled to undergo initial systems testing at Vandenberg, and be disassembled and relocated to an eastern hemisphere location to satisfy Deep Space Surveillance Radar (DSSR) requirements.

Haystack Radar Upgrade. Haystack Radar Upgrade will be a new radar to provide 12 centimeter resolution radar images to the Combined Intelligence Center (CIC). The radar will be available on demand for USSPACECOM tasking.

Headquarters Cargo System (HCS). HCS provides a centralized record of cargo movement requirements to Headquarters AMC.

High Altitude Radiation Detection System (HARDS). A sensor on board the ABNCP that detects atmospheric nuclear detonations. It provides line-of-sight detection capabilities.

High Frequency (HF) Radio. HF Radio provides the capability to transmit voice and data over great distances in various ways, including point-to-point, broadcast, and net control modes of operation.

High Frequency Communication Central (HFCC). The HFCC operating configuration is envisioned as a self contained, stand-alone communications central for the MAGTF. It consists of the HFCC and the major component with a prime mover for transportability and an equipment trailer for power source and other associated equipment. It will also include adequate spare parts, fuel, and a three man operating team capable of sustained operation in the field without external logistics support for a 24 hour period. Logistics support thereafter must be available to assure continuous operation of the system for the MAGTF. The HFCC will be used primarily for long- haul, point-to-point communications within any area of tactical operations or to distant, fixed communications stations. It may be used for beyond-line-of-sight (BLOS) communications between units ashore and amphibious C2 elements afloat. In addition, it may also be used as an HF terminal for air C2 TADIL-A data links, and for shore- based data, voice, and record traffic terminal systems. Follow-on product improvements to the HFCC can provide HF ECCM capabilities and may also provide an interface to the Theater Nuclear Force Communication System. The HFCC will also be utilized as a supplementary or alternative link for UHF, SHF, and EHF satellite systems connectivity from the aviation combat element headquarters to subordinate air bases and air C2 agencies. It will serve as a primary long-haul and BLOS communications means to deployed MEUs, MEBs, and other air deployed Marine Corps forces. Besides the HF transmitting and receiving equipment, the HFCC will also include speech and record cryptographic equipment and record traffic terminal.

High Speed Fleet Broadcast (HSFB). The HSFB program provides an upgrade to the Fleet Broadcast System (FBS) transmission subsystem representing improvements in broadcast transmission speed, information throughput, and resource flexibility. The HSFB upgrade offers the capability to reallocate available information throughput capacity among users in response to changing tactical environments and the ability to handle the traffic quantity and quality demands imposed by high speed automation subsystems. It also provides a more efficient and reliable HF broadcast to forces afloat. As a result, the FBS will be a more responsive C3I link between fleet commanders ashore and their assigned forces. The HSFB is comprised of individually encrypted broadcast packages generated from multiple user subsystems. These broadcast packages are multiplexed into a 9.6 kbps aggregate bit stream used in the satellite transmission medium and a separate 1.2 kbps stream for use in HF. Multiplexing permits multiple user subsystems to share available satellite capacity and at the same time allows a measure of flexibility in altering subsystem bit rates in response to varying tactical operating needs and environments. In addition, forward error correction coding to the signal enhances

broadcast reliability and quality, and provides for the additional bandwidth margin necessary to effectively counter any satellite jamming and interference threat.

HORIZON. Horizon is an overarching USAF strategy for providing the war fighter with responsible, advanced C4I systems services. It will provide reliable, cost-effective, mission- and user-focused C4I systems. It supports the Joint Staff "C4I for the Warrior" concept which emphasizes joint interoperability objectives, derived from joint operational requirements.

Iceland Air Defense System (IADS). The IADS includes upgraded air surveillance radars which are operational and a semi-hardened Control and Reporting Center (CRC) for the air defense of Iceland. The radars provide complete 3D coverage surrounding the island which will be monitored in the CRC.

Image Product Archive (IPA). IPA, a newly developed system element for PA3I program, is installed on all LANs, both SCI and Collateral within in the PA3I. The IPA provides a distributed, standardized library function for imagery and imagery product storage and retrieval by consumers at the National, theater, force and unit levels throughout the world. Its design is base on commercially available hardware and software that conforms to industry and Government standards. IPAs allow: a) visibility into and sharing of image products between different exploitation, production and dissemination centers and DOD and National levels; and b) expansion for the collection/production resources for satisfying requirements, and reduction in collection tasking efforts for data that already exists.

Improved Direct Air Support Center (IDASC). A product improvement program (PIP) which will downsize the existing Direct Air Support Center configuration and provide digital interfaces with the ATAC, DCT, PLRS, and other external C2 systems.

Improved HF Radio Systems (ISHFMR). Improved HF radio systems are required to reduce dependency on UHF satellite communications for long-range command and control (C2). UHF satellite communications can be easily jammed and are susceptible to various man made disturbances. With UHF satellite access being extremely limited, SOF forces are only allocated limited access during real-world scenarios to meet all their long-range, communications requirements. ISHFMR will serve as the non-JASORS objective, HF manpack system for those missions not requiring an LPVD capability.

Improved HF Radio/High Frequency Improvement Program (IHFR/HFIP). The family of Improved HF Radios are made up of three radios, AN/GRC-193, AN/GRC-213 and the AN/PRC-104A. The GRC-193 is a 400 watt vehicle mounted radio while the GRC-213 is a vehicle mounted 20 watt radio. The PRC-104 is a man pack radio and a component of the GRC-213. The AN/PRC-104A IHFR system is a lightweight (14 pounds), man portable HF radio which provides tactical commanders with a reliable, full HF coverage capability to pass secure command and control information over

medium to long distances and over varying degrees of terrain features which normally would preclude the use of VHF/FM combat net radios.

Improved High Altitude Radiation Detection System (IHARDS). A system to detect atmospheric detonations producing radioactivity or EMP. It consists of three sensors and a display module that is installed in the USSTRATCOM Command Center.

Improved Many on Many (IMOM). An application of CTAPS, IMOM provides analytic assistance in evaluating the electronic order of battle, and the effects of stand–off jammers on threats. Analyzes and graphically displays an electronic combat (EC) environment conditioned by the effects of terrain masking on ground radar and accounts for weapon systems capabilities. Designed primarily as a mission analysis tool for manned aircraft, system capabilities include threat display, asset management, defense analysis, SEAD analysis, recce/passive defense analysis, and communications jamming analysis.

Improved Message Entry Device (IMED). Procurement of IMED will provide forces with a lightweight, compact, state-of-the-art interoperable SOF standard Digital Message Entry Device (DMED). KL-43C equipment with integrated COMSEC (ICOM) and variable speed modem (VSM) will be procured.

Improved Remote Monitored Battlefield Sensor System (IREMBASS). IREMBASS is a lightweight, multisensor (magnetic, seismic/acoustic, infrared) system consisting of sensors, relays, and monitors. It will be used for surveillance, detection, target classification, and direction of movements. This system will provide the capability for reconnaissance elements to report movement of enemy echelons/forces without exposing friendly forces in a traditional overwatch position.

Initial Voice Switched Network (ISVN). The IVSN provides an automatic circuit switched telephone network similar to DSN and SVS serving users throughout the NATO Alliance. IVSN is capable of interconnecting non-secure telephones, secure voice subscriber terminals or low speed data terminals up to 2400 tips. IVSN serves as the backup for interconnecting NATO nuclear command and control interests via the SCARS II network. Interconnections with several national voice systems is ongoing, to include: Belgium's BEMILCOM, German Air Force Automatic Communications System (GAFACS), Greek HEDICS, Norway's NDDN, the Turkish Armed Forces Integrated Communications System (TAFICS), the UK's Defense Fixed Telecommunications System (DFTS), and the US DSN.

Integrated Booking System (IBS). IBS will be MTMC's traffic management system at MTMC area commands. It will register cargo for sea lift, provide schedules for unit arrival at ports, and issue port calls to the units. It will replace the Mechanized Export Traffic System II.

Integrated Command, Control, and Communications System (IC3). IC3 will be MSC's C3 system and will be integrated with the Navy's Operations Support System. The Navy system will receive, process, display, maintain and/or access the unit characteristics, employment scheduling, combat readiness, war fighting capabilities and positional information of US and Allied forces.

Integrated Communications Data Base (ICDB). The ICDB contains both satellite and terrestrial communications data, and is the only single consolidated database of all CJCS approved Milsatcom requirements.

Integrated Meteorological System (IMETS). IMETS is a low density single function weather correlation and reporting system specifically designed and implemented to support the commander and soldier via full time interoperability with ABCS and the US Air Force Global Weather Service (USAFGWS). IMETS is Army owned and operated by USAFGWS weather personnel. IMETS employs the ACOE to the maximum extent possible. IMETS employs standard Army shelters and is fully mobile and transportable. There are no plans to migrate IMETS into another system or systems.

Integrated Satellite Control (ISC). Provide unified approach to acquisition of space systems and provide framework for current/planned assets to evolve into total integrated satellite control system. Supports control, maintenance, and operation of USSPACECOM on-orbit assets including surveillance, warning, environmental, navigation and communications satellites.

Integrated Services Digital Network (ISDN). The ISDN uses digital transmission technology to support the integration of voice, data, and image services through standard interfaces over existing Public Switched Telephone Networks (PSTNs). In addition to end-to-end digital services, ISDN also supports interworking with existing and analog voice circuits and terminal equipment. ISDN is a means of integrating communications services as well as modernizing PSTNs to make information management and movement more efficient. It will evolve from the existing PSTNs to combine with other third-party networks, such as packet-switching or satellite. ISDN architecture goals are to combine communications services currently offered over separate networks into a single integrated network to which any subscriber has access. The integration of services offers numerous advantages to subscribers including: access to different network services over a single line; simultaneous digital voice and data; universal access to the network using standard interfaces; circuit- and packet-switched data communications; switched and non-switched dedicated circuits; text message service (e.g., telex, E-mail, fax); and, an assortment of new services and applications facilitated by the ISDN's out-of-band signaling protocols (e.g., video conferencing). In order to provide these kinds of services through a common interface, two technical features are required: digital local transmission loops, and common channel signaling (CCS). The major advantage of digital transmission of the local loop, in addition to its capability to provide the integrated services, is large bandwidths and relative immunity to channel noise. The principal advantage of CCS is that it permits a clear

channel for network signaling and protocol services by separating these overhead services needed to request and maintain services from the actual subscriber services themselves, thereby, providing faster call "setup" and "tear down" times.

Integrated Tactical Strategic Data Networking Program (ITDSN). ITDSN will integrate the existing strategic Defense Data Network (DDN) and the present and planned tactical networks of the Military Services. ITSDN will provide a capability to rapidly and flexibly support the data communications requirements of the tactical user. The existing strategic DDN and the Services' present and planned tactical data networks will be integrated by establishing an internetwork to support all military activities, whether in garrison or mobilized. ITSDN, as an integral part of Defense Information System Network (DISN), provides the necessary interface between tactical elements and strategic long haul C4I systems. ITSDN internetting will allow the tactical user to share resources and access strategic assets available through DISN.

Integrated Vessel Information Planning and Analysis System (IVIPS). IVIPS provides MSC with the record of the voyage and location of ships controlled by MSC, as well as the location of chartered and space-chartered ships operating in the Defense Transportation System (DTS).

Intelligence Analysis System (IAS). IAS is an effort to automate intelligence functions (i.e., direction, collection, processing, production, and dissemination) to assist the MAGTF in focusing and tailoring support to operational needs. IAS will be fielded at the Marine Expeditionary Unit (MEU), Division, Wing, FSSG, Regiment, and Group levels. IAS software includes a situation map (SITMAP) to display friendly and enemy unit locations and other tactical information, an automatic intelligence journal and workbook, a tactical amphibious collection management (TACM) capability, a gazetteer, a message text format editor, and the DELORME mapping system.

Intelligence Correlation Module (ICM). ICM is a software program that provides a capability to correlate, analyze, store, display, and disseminate multi-source intelligence information derived from near real-time and other collection systems/sources. The module will be integrated into the CTAPS as a tool to assist the AOC in ATO generation and battlefield decision making. At the present time, ICM is operated in a collateral environment, but the future maintains a need for it to operate at the SCI level. ICM can operate as a stand-alone program, but is intended to be integrated into CTAPS, with access to data, voice, and radio communications links. ICM will use the Combat Air Force (CAF) standard workstations and servers already resident within CTAPS. The most pressing improvement in ICM's future is the SCI capability, complete with enhanced imagery handling and collection management features.

Intelligence Network (INTELNET). INTELNET will provide an SI satellite voice and data network linking ships at sea with other intelligence subscribers afloat and ashore. INTELNET makes use of the significant capability of the ANDVT, that uses

COTS equipment that is common to all the armed services and numerous Federal Agencies, and a small, omni-directional SATCOM antenna that provides the capability to use both UHF and SHF channels. INTELNET is the Navy's first multi-functional net, a hardware installation designed from the outset to have multiple applications and multiple subscribers as a ship transits from one theater to another. Instead of providing a pathway for a specific function (e.g., tactical air, ship control, OTH-T, etc.), INTELNET is intended to provide multiple pathways for many highly sensitive functions.

Intelligence Pacific Command Center (IPAC). The IPAC is located at CINCPAC Hq, Camp Smith, Hi., and is the central point for receiving, consolidating and disseminating data for the Pacific Theater. As the central collection point for the Pacific it operates at all levels of classification and serves the entire Pacific theater.

International Maritime Satellite (INMARSAT) Satellite Terminal (INMARSAT-ST). The INMARSAT-ST is a lightweight, commercial, satellite terminal which provides global secure voice, facsimile, and data transfer in a point-to-point mode or through an international, commercial, switched, telephone network. INMARSAT-STs are required to reduce dependency on UHF satellite communications for long-range, non-combatant missions. This terminal would primarily be used to provide a direct link between a deployed SOF unit and its headquarters. This system is capable of voice transmission at 9600 bps and data at 56/64 Kbps, weighs 75 pounds, can be set up in five minutes, can be transported as luggage on commercial aircraft, and can accept a wide range of input voltages.

Intransit Visibility – Modernization (ITV–MOD). The Intransit Visibility Modernization (ITV Mod) Program will migrate several stand–alone AMC transportation command and control systems from proprietary Honeywell DPS–90 hardware and software systems to a client–server based architecture residing on Open Systems hardware. This program is designed to establish an integrated corporate system at HQ AMC.

Intratheater Intelligence Communications Network (IINCOMNET). IINCOMNET is a packet switched data network providing a secure and survivable communications system for dissemination of intelligence in a conventional threat environment. It links major intelligence production centers in Europe, interconnects theater processing facilities and operational combat units, and provides gateways to key US and NATO command and control nodes. IINCOMNET operates as a subnet of the DDN for use by USAFE as the primary means in exchanging classified NATO releasable information. It offers teleconferencing, electronic mail, data base query and response, and data base synchronization.

Inverse Synthetic Aperture Radar (ISAR). ISAR has been installed in all S-3B ASW aircraft, ES-3A electronic warfare aircraft, and in at least one P-3C ASW aircraft per squadron. It provides enhanced periscope detection, multiple target tracking of several dozen vessels, additional frequency agility to reduce susceptibility to countermeasures, and has the ability to

provide better classification of surface ships. ISAR provides a continuous-imaging capability through special techniques which generate true, two-dimensional radar images of a recognizable nature of any selected surface platform target. It provides the capability to classify enemy shipping while normally remaining beyond the range of many hostile, surface-to-air missiles (SAMs).

JFACC Decision Support System (JDSS). Will be an executive and staff level information system to support the JFACC. Will provide the capability to access the force–level database for any intelligence, weather, operations, personnel, communications, and logistics information and display it as a graphics overlay or tabular text. JDSS will also provide the capability to manipulate the data for producing tailored reports and briefings.

Joint Advanced Special Operations Radio System (JASORS). JASORS will be the next generation lightweight, tactical, communications capability for deployed US Special Operations Forces (SOFs). The radio will be interoperable with other tactical communications and will provide low probability of intercept (LPI) low probability of detection (LPD), secure voice and data, lightweight, man-portable communications. Capable of transmitting on frequencies across the spectrum, including HF, VHF, UHF, and eventually SHF, it will provide both LOS and BLOS communications capability as a multimode, single-channel radio system. JASORS will consist of several subsystems, including a man-pack radio (MPR); a hand-held intrateam radio (ITR); man-portable, transmit-case base station (TBS); and an integratable base station (IBS).

Joint Casualty Tracing and Cruelty Reporting System (JCT/CRS). The JCT/CRS is a world-wide joint patient tracking system. It will provide a central data base to which joint commands, the Services, and other users can go to determine the location and medical status of a casualty no matter where the individual is undergoing treatment (e.g., from the field hospital to hospitals in CONUS). USTRANSCOM is the lead activity in the development of this system.

Joint Chiefs of Staff Alerting Network (JCSAN). JCSAN is a dedicated communications network which provides alert notices from the NCA to the CINCs.

Joint Communications Support Element (JCSE). This program upgrades and replaces the CJCS' contingency communications assets used for CINC support to ensure reliable communications, provide greater interoperability with Service equipment, and improve communications capabilities to meet future requirements Package consists of multimedia, flexible, deployable tactical communications equipment operated by a dedicated active communications support unit and augmented by two Air National Guard Joint Communications Support Squadrons (JCSS) JCSE assets are controlled by the CJCS and are deployed to provide simultaneous communications support for two JTF HQs and two JSOTF HQs. Augments/provides CJCS-directed contingency and crises communications support to meet operational and support

needs of JCS, the Services, U&S commands, DOD and non-DOD agencies, and foreign governments. Until mobilized, JCSSs are controlled by the National Guard Bureau.

Joint Crisis Management Capability (JCMC). JCMC Level 2 is an airborne command, control, and communications capability immediately responsible to the Unified and Specified Commanders. It is designed to provide communications between a crisis scene, the appropriate area, and the NCA, to support rapid crisis situation assessment during disaster relief, contingency operations, or joint training exercises. It provides an airborne commander with command and control communications to deployed forces, higher headquarters, and the NCA. The system provides one full duplex HF/ISB radio, two UHF/AM radios, three VHF/FM radios and one VHF/AM radio for voice communications. Specially modified C-130E/H or C-141B aircraft permit the simultaneous use of all radios. One UHF satellite radios is available for voice or data communications; a second can be installed using a hatch mounted antenna. Two full duplex teletype circuits may be terminated in the communications center. Any of these systems may be selectively secured. Standard configuration includes one communications shelter, one operations shelter, and one staff shelter.

Joint Decision Support System (JDSS). Provides the Joint Staff and CINC J-6 with an automated decision support methodology and tool for the development of C4I system assessments and master plans; relates C4I systems and objectives to specific military mission elements. JDSS Version 3.0 Rolls up C4I systems assessments using expert value judgments, structures information for prioritizing objectives, and rank orders C4I systems by warfighting needs.

Joint Deployable Intelligence Support System (JDISS). JDISS is the coordinated, General Defense Intelligence Program community sponsored system to provide intelligence support to deployed Joint Task Forces (JTFs). The program was established to provide: 1) deployed JTF commanders access to theater and national intelligence; 2) deployed JTF commanders the means to transmit tactically derived information back to the national community: 3) on-demand broad bandwidth intelligence communications connectivity; and 4) a family of DODIIS standardized high performance workstations, communications equipment, cryptographic devices, transport packing, software and life cycle support. JDISS is integrated from commercial off the shelf and government off the shelf products.

Joint Doctrine Data Net (JDDN). JDDN is a multi-user electronic mail and bulletin board system for use in the development and review of joint doctrine/tactics, techniques, and procedures.

Joint Flow and Analysis System for Transportation (JFAST). JFAST is an application program subset of the GTN and the Technology Improvement Program of JOPES. It is used for estimating the flow of an overseas deployment. It provides the capability to rapidly assist the transportation feasibility of strategic deployment from a lift asset capability and closure profile by depicting discrepancies among movement requirements and actual deliveries.

Joint Force Reception And Onward Movement (JFROM). JFROM is a USEUCOM command and control tool that provides: enhanced JOPES strategic visibility; in-theater tactical deployment and readiness visibility; data fusion of multiple external data sources into a single integrated workstation; graphical display of deployment and reception on mapped background; and both structured and ad-hoc retrievals of forms and reports.

Joint Maritime Command Information System (JMCIS). The JMCIS is one of two large C2 systems (the other being the NTCSS) in which the Navy's series of computer programs are being integrated. The JMCIS is a subset of the Navy's SONATA, which is in turn a subset of the GCCS. The program is designed to eliminate specialized computer and unique software, and to help to adopt standard software and computer hardware in line with DOD policy. The JMCIS is an operational C2 system providing tactical C2I planning, execution and supervision support for all warfare areas. JMCIS supports the C2I mission requirements of joint, Navy, and USMC commanders, as well as facilitating information exchange with national, joint, and theater level command authorities. It will combine the existing C2 programs used by the warrior to direct navel forces against enemy weaponry. These programs include the NTCS-A, the Operations and Support System, the Naval Command System Integrated Tactical Environment subsystem, and the Navigation Sensor Systems Interface Program. It provides timely, accurate, and complete all-source information management, display, and dissemination capabilities. The core system of the JMCIS is the Unified Build (UBII) software, which is the fundamental building block for all Navy tactical C2 applications software. The OSS, together with the UBII, has been chosen to serve as the foundation the GCCS, the "shell that everything will be built upon".

Joint Maritime Information Element Support System (JSS). JSS is a centralized maritime intelligence support system, housing an extensive maritime data base. It serves as a central pool of maritime related vessel data which is library-like in function and use, accessible to all JSS users, unsupported by an analytical staff, and provides information for manipulation by users.

Joint Message Analysis and Processing System (JMAPS). Provides United States Message Text Formatted (USMTF) Message processing. Supports manual message preparation, validation of received USMTF messages for compliance with the USMTF message standard as described in Joint Publication 6–04, extracting (parsing) user defined information from received messages for further processing/updating of databases and facilitating automatic generation of USMTF messages with information extracted from operational databases.

Joint Mobile Command Capability (JMCC). The JMCC requirement is for a mobile, integrated, modular C4I capability that is readily available to support the JTF commander under varying contingency situations from disaster relief of humanitarian aid to a full range of combat operations with combined land, air, and naval forces. The JMCC must enable the JTF commander to be augmented by, or collocated with command elements of his supporting component/combined

warfighting forces. A key requirement is to link the JTF commander with his forward operating forces, the theater CINC, and the NCA in a fully integrated joint mobile C3I capability. The JMCC must be a robust, scalable system with sufficient accommodations and C2 space to support a CJTF from any Service at the level needed to support the JTF mission. JMCC capabilities must include a Joint Operations Center (JOC), a JIC, and a Logistics Readiness Center (LRC) and it should be able to expand as necessary to support all elements of the National Intelligence Support Team (NIST), the Joint Forces Fires Coordinator (JFFC), Joint Force Air Component Commander (JFACC), Joint Special Operations Forces (JSOF) liaison teams, and tailored Service component commander staffs or liaison teams. It must include the capability to receive, process, exploit, and disseminate theater/tactical sensor data including imagery intelligence (IMINT) and SIGINT. JMCC communications design must support the C4I for the Warrior C4IFTW) architecture and must be flexible enough to operate over MILSATCOM, commercial satellites, and when required, over allied satellites.

Joint Publication Management System (JPMS). JPMS facilitates the management of joint publications.

Joint Resource Assessment Data Base Report System (JRADS). JRADS will provide an automated system for the collection, transmissions, editing, and update of US military fixed resources contained in the Joint Resource Assessment data base during a peacetime environment and reporting damage to these resources during the three time phases subsequent to a real (or simulated) nuclear attack upon the US in support of a Residual Capability Assessment. JRADS will be used by NCA to formulate further military action.

Joint Operational Tactical System (JOTS). JOTS is a precursor to and has been incorporated into the Navy Tactical Command System-Afloat (NTCS-A). JOTS is a desktop computer based tactical information transfer, display and decision aid system. It uses existing communications links and C2 system interfaces to provide users with a near real time maritime battle management and command control system for displaying worldwide force locating data. JOTS receives, processes, and displays data directly from various broadcasts, including OTCIXS, TADIXS A, and NTDS Link 11/14. It automatically processes certain incoming message formats, such as US Message Text Formats and satellite vulnerability reports. JOTS also performs other functions such as multi-source track association/matching, contact management, query and status, and formation and track management. It generates and exchanges color tactical graphic displays, formats and hard copy on request.

Joint Operational Tactical System/Visual Display System (JOTS/VIDS). The JOTS/JVIDS is a desktop computer-based tactical information transfer, display, and decision aid system. The system uses existing communications links and C2 system interfaces. It provides users with a near real-time maritime battle management and C2 system for the display of worldwide force locating data.

Joint Operations Planning And Execution System (JOPES). JOPES is an integrated command and control system used to support joint conventional military operation planning (to include theater-level nuclear and chemical planning activities) and monitoring requirements for mobilization, deployment, employment, and sustainment. JOPES provides senior level decision makers and staffs of the NCA, JCS, CINCs, Component Commands, Military Services, and agencies of the DOD with an enhanced capability to plan, coordinate, and conduct joint military operations. JOPES has the capability for supported commanders to identify between requirements and capabilities, and procedures to conduct risk analysis, resolve shortfalls, and redefine strategic concepts if risks are too great.

Joint Service Imagery Processing System (Nat'l Segment) (JSIPS-NS). The JSIPS is a mobile ground processing facility designed to receive and exploit imagery from national and theater sources. Product improvement options include a common radar processor to process both tactical and theater radars, and an automated capability to insert and process mapping, charting, and geodesy products. The technology thrust is to NRT, soft-copy, digital imagery, which is linked from the sensor platform to the processing facility.

Joint Service Imagery Processing System (Tactical Segment) (JSIPS-TS). JSIPS is a DOD common transportable ground station which receives, processes, exploits, and disseminates time-sensitive all-source imagery products and imagery derived intelligence reports in near real time. The Army has already fielded JSIPS; the Air Force and Marine Corps has the JSIPS system in development/test at Eglin Air Force Base with the requirement that it could be ready for operational use in 30 days if required; the Navy's system is in development The JSIPS system is transportable in ruggedized shelters with EMP protection.

Joint Spectrum Management System (JSMS). The JSMS is a personal computer based (UNIX/DOS) system capable of providing near real time management, analysis, engineering, and deconfliction of the frequency spectrum at all levels of command and the capability of interchanging this data with multi-service/multi-national organizations. This system provides the commander with the information and flexibility required in various scenarios and is especially suited for contingencies and deployments.

Joint Surveillance Target Attack Radar System (JSTARS). Joint Stars is a joint Air Force/Army program, replaces PAVE MOVER, to develop an airborne phased array radar system for detecting, tracking, and directing weapons against mobile and mobile/stationary ground targets. The system uses a Boeing E-8A aircraft equipped with a phased-array antenna in a conformal belly pod that can operate both as a synthetic aperture side-looking radar to detect fixed surface targets or in a doppler mode to detect slow moving vehicles on a time sharing basis. The system includes the Army AN/TSQ-132 truck mounted ground station modules and data link connectivity for transmitting raw radar data to the Army ground stations. Targeting information is transmitted to Air Force controllers on the ground via JTIDS and can

also be provided directly to JTIDS equipped tactical aircraft. The E-8A is equipped for secure communications using HAVE QUICK and SINCGARS for anti-jam communications with Army units.

Joint Tactical Information Distribution System (JTIDS). JTIDS is a high capacity, high speed, spread spectrum/TDMA information distribution system to provide selected US Air Force and Navy Airborne Warning And Control System (AWACS) and tactical units with crypto secure, jam resistant, low probability of exploitation tactical data and voice communications. It will provide precise Tactical Aids to Navigation (TACAN), relative navigation, and identification, and will have additional capabilities of common grid navigation. It will also use automatic relay capability inherent in the long range communications equipment. The system will be interoperable among the Services and NATO/Allied users equipped with JTIDS or the NATO Multifunctional Information Distribution System (MIDS). (Germany, Italy, France, and Spain will have this capability.)

Joint Universal Lessons Learned System (JULLS). JULLS provides a reference file for lessons learned during joint exercises.

Joint Visually Integrated Display System (JVIDS). JVIDS provides the capability to monitor the positions and status of US naval ships, convoys, foreign naval ships, and merchant ships on a digital map. It receives intelligence reports from US naval hips and updates the Atlantic and Pacific C2 centers and provides digital mapping of the ships and their locations.

Joint Worldwide Intelligence Communications System (JWICS). JWICS is a SCI high, interactive video teleconferencing system connecting Indications and Warning centers and the Washington area Secure Video Teleconferencing System. It enables I&W centers to share timely information with other Watch Centers throughout DOD in order to ensure 24 hour a day operational intelligence support for worldwide events of concern to senior decisionamkers. It is used to "broadcast" daily and/or crisis intelligence briefings from anyone site to one or more sites. In addition to video teleconferencing capabilities, JWICS provides capabilities for transmission of photographs, maps, or other graphic materials.

LAJES Command Post (CP) Upgrade. A joint command post is being established to improve Commander US Forces Azores (COMUSFORAZ) warfighting capability by providing a secure, centrally located, C2 center for all US peacetime and contingency operations throughout the Azores area of responsibility (AOR). Improvements include dedicated secure voice, secure teletype, clear voice communications systems that are capable of operating on HF, VHF, and UHF transmission media and over wireline and satellite paths.

Land Satellite (LANDSAT) 7. LANDSAT 7 will improve Multispectral Imagery (MSI) data access through direct theater downlink and Tracking Data Relay Satellite System (TDRSS) crosslink.

LANTCOM Theater Intelligence Network (LATIN). LATIN is the name of the program to implement the USCINCLANT/ Commander in Chief US Atlantic Fleet (CINCLANTFLT) IDHS functional capabilities and provide the communications connectivity to the DDN DSNET 3 SCI Network for all headquarters users and subordinate commands connected to the IDHS. This program is also used to identify and provide the communications necessary to connect LANTFLT users to the LANTCOM IDHS. A follow-on effort is already underway to implement a new five year effort to continue LATIN modernization and network expansion.

Lift Manager (LIFTMGR). LIFTMGR is a collection of command unique automated tools designed for use in the USTRANSCOM command centers and Crisis Action Teams. These tools allow USTRANSCOM to plan and operate airlift and sea lift allocations through the entire operations spectrum. LIFTMGR provides the rapid and detailed "what if" analysis needed for USTRANSCOM's C2.

Lightweight Computer Unit (LCU). The LCU is an Army tactical computer system which is being purchased for Army SOF to fulfill inventory objectives not met by the Lightweight Deployable Communication (LDC) system.

Limited Operational Capability (LOC). LOC is the official gateway to the NATO Allied Command Europe (ACE) Battlefield Information Collection and Exploitation System (BICES). Most LOC users are foreign national. There is a direct, two way interface between LOC and the German JASMIN intelligence system, which operates at the German equivalent of SECRET. LOC also feeds the NATO Central Region Command and Control Information System (CCIS) through a two way interface.

Logistic Sustainment Analysis and Feasibility Estimator (LOGSAFE). LOGSAFE is an application program subset of the GTN and the Technology Improvement Program of JOPES. LOGSAFE provides stand-alone, deliberate planning, logistics sustainment analysis, feasibility estimation, resupply requirements generation, and appraisal of contingency plans.

Logistics Intercomputer Network/Movement Information Network (LINK/MINET). LINK is the outgrowth of an earlier EUCOM project to extend and develop the Movements Information Network (MINET) to more fully support the USEUCOM logistics mission. LINK was developed for the EUCOM AOR in collaboration with the Lawrence Livermore National Laboratory and has been incorporated into the DOD's project to implement Electronic Commerce through Electronic Data Interchange as an operational prototype. LINK provides visibility of logistics assets in CONUS, in-transit, and in Europe to EUCOM J4, component, and Defense Logistics Agency (DLA) users. It provides EUCOM personnel a decision support system with access to logistic databases, both commercial and military, worldwide.

Long Range Imagery Networked Communications System (LINCS). There are currently a number of incompatible secondary imagery dissemination systems (SIDS) causing inter operability problems. The LINCS program will replace current systems with a compatible solution based on a system compliant with DODIIS standards. Under this program, imagery exploitation capabilities will be integrated into the EUCOM Intelligence Support System (EISS) and then expanded to current SIDS users. Since some SIDS users must operate at the SECRET collateral level, a restricted version of EISS will be created and provided to these users. Imagery products will be manually transferred between the systems after classification downgrading.

MAGTF Data Library (MDL). MDL programs encompass source planning management and technical data extracted from mainframe databases/systems on a monthly basis. Acts as the origin of all standard source data elements used by the MAGTF II/LOG AIS family of systems, and contains critical elements such as Tables of Organization/Equipment, ammunition consumption factors, and aviation data.

MAGTF Development Support System II (MDSS II). Enables Commanders at various echelons of MAGTF to build and maintain a database that contains force and equipment data reflecting how the MAGTF is configured for deployment.

MAGTF Warplanning Model II (MAGTF II). A system that allows MAGTF planners to select and tailor MAGTF force structures, estimate sustainment, and estimate airlift/sealift requirements for plan feasibility.

Maintenance Resource Management System (MRMS). The single management information system for ship intermediate maintenance. The MRMS program includes hardware, software, communications and logistics support and is installed aboard Aircraft Carriers, Destroyers/Submarine Tenders and large Amphibious Ships."

Malfunction Detection and Recording System and Ground Processing System (GO81). GO81 provides the Air Mobility Command both a worldwide maintenance management system and a Logistics Command and Control (C2) capability for aircraft. The system is considered a Mission Critical Computer Resource (MCCR) for all mobility airlift (C–5s, C–141s, C–17s, KC–10s and KC– 135s). The system provides for real time updates and access to critical logistics information from AMC bases worldwide.

Man-Transportable SOCRATES (MTS). The MTS is a highly mobile system which will give deployed intelligence personnel at the deployed component-level automated tools similar to those provided by the SOCRATES system in garrison.

Maneuver Control System (MCS). The MCS is one of five Army Command and Control System (ACCS) programs intended to automate the battlefield. MCS automates C2 in Armor, Infantry, and Combined Arms formations and interfaces with other functionally oriented battlefield C2 systems. MCS will be the primary tool for collecting, analyzing, generating,

and distributing tactical information and orders. MCS provides advanced electronic mapping capability by allowing map makers to draw information from five databases that track friendly forces, enemy forces, control measures, obstacle barriers, and nuclear, biological, and chemical data. MCS has an automatic database replication feature and an interface to the Standard Theater Army Command and Control System (STACCS), HEROS (Germany), WAVELL (UK), SACRA (FR), and WWMCCS . The MCS began transitioning to the digital computer system acquired for the ATCCS in 1994.

Mapping Analysis Tool for Transportation (MATT). MATT will integrate current/planned sources of worldwide transportation facility and capability information with related mapping, charting, geodesy, and imagery/photography products to provide a highly graphic, interactive representation of the physical transportation situation for use by USTRANSCOM and TCCs.

Marine Air Ground Task Force Lift Module II (MAGTF II). MAGTF II will provide Marine Corps/Navy common-user air and surface lift requirements. MAGTF II is the Marine Corps/Navy version of TCAIMS Micro-Based Budget Automated System (MICROBAS). MICROBAS extracts budget data from the Defense Finance Accounting System for budget planning and execution.

Marine Corps Data Network (MCDN). The MCDN is a subset of the DISN-NT consolidation effort. It is primarily a CONUS-wide network (one location in Okinawa), consisting of 15 nodes and with T1 connectivity among nodes. Leased facilities are used to provide the long-haul connectivity for the network.

Marine Combat Service Support Command and Control System (MCSSC2). An automated combat service support command and control system that serves as an umbrella system within the MAGTF C4I command and control system.

Marine Corps Tactical Air C2 System (MTACCS). The MTACCS is the USMC tactical C3 program designed to provide communications program designed to provide communications and other systems that allow FMF tactical commanders to exercise C2 over assigned forces. Currently MTACCS includes the following systems: Intelligence Analysis System (IAS); Marine Air-Ground Intelligence System (MAGIS); Tactical Combat Operations (TCO) System; USMC fire support systems FIREMAN and FIREFLEX; Position Location and Reporting System (PLRS); Tactical Air Operations Module (TAOM); and Improved Direct Air Support Center (IDASC).

Marine Corps Total Force System (MCTFS). An integrated system of automated pay and manpower information reporting procedures, centralized processing and distributed databases. The system provides for recording, processing, and maintaining of military personnel and pay data on a continuing basis.

Maritime Defense Zone Command, Control, and Communications (MDZ C3). MDZ C3 project will integrate Navy and Coast Guard assets into the coastal defense plan of the United States. This project will provide C2 interfaces and secure communications equipment between Navy and Coast Guard platforms and shore stations in time of crisis. The system itself will use NDI communications gear and commercial computer hardware. This project is an effort to use communications and computer equipment to provide accurate and effective C3 interfaces between Navy and Coast Guard assets.

Message Text Format Editor/Joint Message Preparation System (MTFE/JMPS). A Joint Staff initiative replacing the MTF Editor, to develop a single USMTF message preparation module for use by all of DOD. Provides message validation to ensure adherence to the standard and ensure acceptance of the message by automated systems.

Military Airlift Command Planner's Tool Kit (MPT). MPT, an AMC system, provides airlift planners with a set of analytic tools to quickly address specific problems associated with the analysis of small contingencies. Its major capabilities include analyzing he change of a single mission in a larger deployment plan without having to recalculate the entire airlift schedule; estimating gross closure profiles from aggregated movement requirements; querying and displaying station aircraft data; and calculating distances and flying times.

Military Airlift Integrated Reporting System (MAIRS). MAIRS, an AMC system, records and displays airlift schedules, aircraft arrivals and departures, and aircraft status.

Military Export Traffic System II (METS II). METS II is the traffic management system at MTMC area commands. It provides schedules for unit arrival at ports and issues port calls to the units. METS II will be replaced by IBS.

Military Network (MILNET). The MILNET is a subset of the DISN-NT consolidation effort. It is a worldwide, unclassified common-user, packet-switching, data communications network that provides data exchange services and related support services to the DOD users. The current estimation of user devices accessing the MILNET is in excess of 3000 hosts within 500 Local Distribution Systems.

MILSATCOM Polar Adjunct. The current satellites providing polar support do not meet warfighter requirements and are nearing the end of their expected lifetimes. The MILSATCOM polar adjunct will provide satellite communications for forces operating in the northern latitudes (65°N - 90°N). The USN is working on a Milstar compatible, near-term (1997 launch) interim system which will provide limited polar support. USAF is working on a Milstar compatible system designed for full requirements satisfactions with a projected launch NLT 2003.

MILSTAR. The Military Strategic - Tactical Relay Program (MILSTAR) Satellite Communications System is being designed as a new generation communications system to meet the projected minimum essential wartime operational requirements associated with military communications. The program objective is to develop and deploy an affordable terminal and satellite system with jam-resistant capability to satisfy specified strategic and tactical long-haul and local communication requirements. MILSTAR will be comprised of a Space Segment, a Mission Control Segment (MCS), and a Terminal Segment. The MCS provides the collective equipment, facilities, and support to provide space segment control and to support communications control. MILSTAR will employ terminals developed by the Army (MILSTAR Single Objective Tactical Terminals or SCOTT), Navy, and Air Force and will be deployed on airborne, shipboard and ground platforms.

Milstar Terminals. Provides secure, survivable communications to US warfighting forces during all levels of conflict via Milstar satellite A Mix of fixed, ground-transportable, manportable, airborne and shipborne terminals. Supports wide range of Milstar users (SIOP execution, tactical force deployment, critical warfighting missions). Approximately 1200 terminals currently planned.

Miniature Multiband Beacon (MMB) (AN/PPN-20). A self-contained, lightweight man-portable, navigation beacon used for radar navigation, offset beacon bombing and all-weather, drop-zone marking. Weighs less than 12 pounds and is less than 400 cubic inches in size. Operates in the X and KU radar bands when activated by properly equipped NATO aircraft. The MMB consists of a transponder set AN/PPN-20 and a test set AN/PPN-4.

Miniature Receive Terminal (MRT). MRT provides a vital VLF/LF communications link to the B-1B and B-52H bombers at (or enroute to) their positive control turnaround points. This will assure reliable and survivable emergency action messages receipt in a nuclear stressed environment. The MRT is EMP hardened, secure, jam-resistant, and provides the following capabilities: frequency and mode scanning, MEECN interoperability, message piecing, and polarization diversified. It consists of receiver with a plug-in transfer module for encryption variables and mission profiles, three antennas, a remote control unit, and a printer.

Miniaturized Airborne GPS Receiver (MAGR). Several potential Navigation Satellite Timing and Ranging (NAVSTAR) GPS users are unable to employ the existing Rockwell-Collins airborne user equipment because of space and/or weight constraints. The MAGR acquisition program is responding to these needs through the acquisition of a small, lighter receiver. The MAGR will consist of an antenna, a signal receiver/processor, and a control/display unit which processes and displays three dimensional user position, as well as velocity, time, and distance traveled.

Miniaturized Satellite Threat Reporting System (MSTRS). MSTRS is a modular satellite subsystem that will detect and report hostile acts against US space assets. The MSTRS will consist of an array of threat detection sensors that feed into a central processor. The MSTRS ground segment will interpret the transmission and present the information to a ground operator.

Missile Graphics Planning System (MGPS). This is a graphics based user interface system which supports interactive missile allocation/application, missile maintenance and SSBN launch patrol areas. This system displays the location and characteristics of weapon assignments and targets plus submarine launch patrol areas.

Mission Data Preparation System (MDPS). MDPS provides the link between the SMDPS and the B-52G/H Offensive Avionics System (OAS) including the Air Launched Cruise Missile (ALCM). MDPS also validates mission data and simulates B-52/ALCM flight performance including time, fuel and distance.

Mobile Operations Control Center (MOCC). The MOCC is a rapidly deployable, P-3 aircraft, C3 ground support system designed to support Maritime Patrol Aircraft (MPA) operations from advanced bases worldwide during peacetime, contingencies, or full mobilization. The MOCC is completely self-contained for power, computer resources, and communications and is modular in design to provide flexibility to meet specific mission requirements for short or long-term deployments. MOCC equipment is containerized and can be transported to a mobilization site aboard two P-3 aircraft. The MOCC emulates the critical support functions of a shore-based ASWOC, including acoustic analysis, C2, ADP, and communications. Where they exist, MOCCs will be co-located with the ASWOCs.

Mobile Subscriber Equipment (MSE). The MSE provides the Army with a highly mobile all-digital, secure, automatic-switching tactical communication capability for use at the corps level. MSE provides voice, data, teletype, and facsimile communications for digital radio telephone users, switched-system subscribers, and Combat Net Radio (CNR) users. MSE permits mobile users anywhere in the corps area to place and receive calls similar to using a telephone. The system will significantly reduce the need to install wire and cable when establishing command posts. It will consist of five major hardware functional elements: subscriber terminals, multiple subscriber terminals, wire subscriber access, area coverage, and system control.

Mobility Analysis and Planning System II (MAPS II). MAPS II provides MTMC with the capability to develop management tables from time-phased deployment data inserted during the deliberate planning process. It also assists in development of movement schedules for execution and performance of transportation feasibility analyses. MAPS II will be replaced by the Strategic Deployment System.

Mobility Analysis Support System (MASS). The Mobility Analysis Support Systems (MASS) provide a set of simulation, modeling, and analysis tools to answer questions related to mobility airlift and tanker operations posed by the AMC Staff, USTRANSOM, HQ Air Force, JCS Joint Staff, and the OSD. The MASS is used in wartime operations in making informed decisions on the use and deployment of airlift assets, and the timing of reserve and CRAF activation.

Modular Air Operations Center (MAOC) Improvement Program. The MAOC Improvement Program provides a complete hardware upgrade to effect a fully automated, integrated, and interoperable operations for deployable MAOCs. In addition, it replaces current structures with 3: 1 expandable shelters. Within the Air Force TACS, the AOC is the senior element and is normally located with the Air Force Component Headquarters on or near a tactical air base. The AOC performs basic C3 functions, including input to the theater level commander. The AOC is required to assimilate, evaluate, and disseminate large amounts of information to manage tactical air operations and is organized into four functional divisions: Current Plans, Current Operations, Intelligence, and Fusion. Planned improvements include the addition of the Advanced Planning System and the Tactical Information Situation Display (TISD).

Modular Communications (MODCOM). MODCOM, AN/TSC-132, will provide palletizable modular communications suites for a minimum Task Unit communications capability in situations when aircraft space is not available for full size Task Unit communications systems or where a Task Unit C3 Van is not applicable (i.e., Advance Control Element/Forward Control Element).

Modular Control Equipment /Tactical Air Operations Module (MCE/TAOM). A joint Marine Corps and Air Force program, MCE/TAOM is a modular, transportable, automated C2 system for controlling and coordinating employment of aircraft and surface-to-air missiles. It serves as an interface to receive, process, display, and transmit surveillance radar data. It receives inputs from search radar and Identification, Friend or Foe (IF-systems) and performs automatic track correlation, acquisition, identification, classification, tracking, threat evaluation, and weapon selection, assignment, and control. It receives and processes track information, orders, command, and status data received via digital data links from other command and control systems, and from weapon systems with digital data link capability (TADIL A, TADIL B, TADIL C, Air Tactical Data Link (ATDL)-1, NATO Link 11, and JTIDS); processes inputs from operator consoles for entry, deletion or modification of stored information and initiating appropriate action both within the TAOM and external to the TAOM; and displays real time tactical air situation based on all system inputs. TAOM improves coordination and exchange of information among joint and combined Air Defense elements.

Movement Reporting System Fleet Movement Report (MOVREP). MOVREP collects data on the location and movement of ships in which the Navy has a direct interest available to certain authorities.

Multidimensional Application Gbps Internet Consortium (MAGIC). MAGIC is a gigabit Wide Area Network (WAN) which is a component of the Global Grid designed to provide commanders with a common view of the battlefield. For tactical C2 on the move the warrior will require small/lightweight equipment. DOD will need multiband and software reconfigurable antenna to help provide this capability for high capacity connectivity.

Multifunction Radar Transponder System (MFRTS) (AN/PPN-19). The AN/PPN-19 provides terminal guidance for off-set radar bombing, navigation, and air drops. It is a self-contained, man-portable unit (weighs about 32 lb.) designed to respond to aircraft radar interrogations with a coded information reply, transferring ground location information to aircraft. The AN/PPN-19's three-band capability replaces three transponders. Mission: Provide terminal guidance for aircraft, naval gunfire, and drop/landing zone location.

Multilevel Security (MLS) TIP (MLS TIP). The DOD MLS Program was established by OASD/C3I and the Joint Staff to accelerate fielding of MLS technology into command and control systems at the CINCs and other commands. MLS technology enables secure interoperability among systems that process data at different classification levels. True MLS technology will permit cleared users to access multilevel systems/data bases, but limit their access to data consistent with their clearance. Existing and near-term MLS technology enables access and interoperability across adjacent classification levels only (e.g., Top Secret to Secret but not TOP Secret to Unclassified).

Multiple Engagement Module (MEM). MEM models the attrition of US ICBMs and SLBMs against the Moscow ABM system. Combined Timing and Resolution (CT&R). This module examines and resolves potential SIOP conflicts for aircraft, cruise missile and ballistic missile missions. It applies timing and adjustments to provide safe separation between mission routes and planned weapon detonations. It resolves timing for any subset of SIOP missions. It also adjusts mission timing to provide safe separation between vehicles and weapons.

Multisource Data Production System (CDPS) Multisource Data Base/Integrated Data Base (MSDB/IDB). MSDB/IDB is the primary segment of the USSTRATCOM IDHS and provides automated support across the spectrum of intelligence disciplines. MIIDS is a shared database, compatible with DOD data element standards, and organized around installation and equipment data to permit automated support in each phase of the intelligence cycle.

Multispectral Imagery and Materials Exploitation System (MIMES). The MIMES provides the ability to analyze, manipulate and produce multi-spectral imagery source material and MC&G products to develop target materials tailored to user requirements (e.g., perspective scenes for aircrews). The analyst generates magnetic tapes for targeting personnel (using RTAPS) to produce area limitation studies and terrain categories; to produce products supplementing traditional

cartographic coverage or maps of previously uncharted areas for relocatable targets; and as automatic change detection to cue high resolution sensors.

Multi-User Special Intelligence Communications System (MUSIC). MUSIC provides an exchange of Special Intelligence Information. MUSIC is an automated communications system that interfaces existing communications networks and incorporates the ability to receive, screen, and relay SCI tactical intelligence support to operational commanders afloat and ashore automatically. It is a multi-format system, capable of processing data in a variety of formats. It can also establish exchanges of information among its subscribers.

National Information Infrastructure (NII). The NII includes more than just the physical facilities used to transmit, store, process, and display voice, data, and images. It encompasses a wide and ever-expanding range of equipment and software.

NATO Air Base Satellite Communications (NABS). The NABS is a US Air Force initiative to procure and install transportable SHF satellite ground terminals at European air bases to provide wartime primary, jam resistant communications for command and control of US Air Forces that have changed operational control to NATO. NABS terminals are also located at selected ACE air operations centers. NABS will use NATO SATCOM IV and will be under the control of the NATO Integrated Communications System (NICS) Central Operating Authority. There are two basic types of terminals: NABS "A" terminals provide one link with up to 2S50 tips per link and "B" terminals provide four links. The majority of equipment components and quick erecting antennas are common to the GMFSC program.

NATO Integrated Communications System (NICS). The NICS is composed of six subsystem: Initial Voice Switched Network (IVSN) to include secure voice; Telegraph Automated Relay Equipment Network (TARE); NATO SATCOM; NICS Data Network; NICS Secure Facsimile Network; and NATO Terrestrial Transmission System (NTTS).

NATO Terrestrial Transmission System (NTTS). NTTS is the replacement of the ACE HIGH transmission system. It uses host country national defense systems and PT Ts with NATO cross border links. NTTS is a single thread transmission system, gritted to provide redundant connectivity path and a switched capability for automatic restoration of transmission.

Naval Aviation Logistics Command Management Information System (NALCOMIS). An integral component of the Navy Tactical Command Support System (NTCSS), NALCOMIS is an on-line management information system supporting aircraft organizational and intermediate maintenance and material management requirements aboard aircraft carriers, amphibious aviation helicopter assault ships, Marine Aviation Logistics Squadrons, and Naval/Marine Corps Air Stations.

Naval Intelligence Communications Systems (INTELNET). The NICS is designed to consolidate Naval intelligence communications systems. The system has three parts. INTELCAST plan calls for each FOCIC or Facility to consolidate up to 12 different message traffic circuits, including OPINTEL, MUSIC, FIST, and DODIIS through INTELDATA future extensions. The INTELNET concepts calls for the creation of an SCI voice net capability similar to NSA's STICS/TRIBUTARY packages. INTELNET is to be installed in all SCI-capable ships, vans, and possible aircraft, and will be used in crisis action situations, special operations and contingencies.

Naval Intelligence Processing System (NIPS). The Naval Intelligence Processing System (NIPS) provides a comprehensive military intelligence data base which is used to support strike warfare, amphibious warfare, air operations, mission planning, and the command and control needs of the Naval and/or Joint Task Force Commander. It consists of a technical data base of friendly, neutral, and enemy systems and unit characteristics, orders of battle and capabilities. The NIPS system and its Central Data Base is an integral part of the Navy's NTCS–A/Unified Build Program and has been developed as part of the Navy's migration strategy in support of GCCS.

Naval Oceanographic Data Distribution and Expansion System (NODDES). NODDES will replace the obsolete Naval Environmental Display System (NEDS) and currently in use by the Naval Oceanography Command (NAVOCEANCOM) at its regional center, NAVEASTOCEANCEN. It will include the integration of DDN connectivity, will replace the Naval Environmental Data Network (NEDN) and allow NAVOCEANCOM to accomplish its mission. NODDES will meet all existing requirements for communicating grid fields and products from the primary production centers, the Fleet Numerical Oceanography Center (FNOC) and the Naval Oceanographic Office (NAVOCEANO), to the five regional centers, platforms afloat, and NAVOCEANCOM shore activities. NODDES will accomplish five concurrent functions of data collection; data assimilation; product generation; interpretation; and distribution. The NODDES will interface with the NTCS-A, HSFB, Antisubmarine Warfare Center Command and Control System (ASWCCCS), and local area networks.

Naval Tactical Command Support System (NTCSS). The NTCSS is one of two large C2 systems (the other being the JMCIS) in which the Navy's series of computer programs are being integrated. The program is designed to eliminate specialized computer and unique software, and to help to adopt standard software and computer hardware in line with DOD policy. The NTCSS will combine the programs used by shipboard logisticians to track supplies, oversee weapon maintenance and manage personnel. These programs include the Maintenance Resource Management System, the Naval Aviation Logistics Command Management Information System and the Shipboard Naval Automatic Data Processing Program.

Naval Telecommunications System (NTS). The NTS is a worldwide naval communications system for exchange of information between naval forces at sea, in the air, and ashore. It is controlled by four NCTAMS which have automatic switching

and message processing capabilities to provide the principal interface with the DCS for connectivity between shore commands and the fleet. This system provides transmission of fleet broadcast information on either HF radios or UHF satellite communications and the interface between shipboard and shore based voice, data, and imagery systems. NTS offers service from data rates of 75 words per minute with VLF broadcast to multi-kilobit rates. Connectivity is provided through FLTSATCOM, HF, and SHF systems.

Navigation Sensor System Interface Program (NSSIP). The NSSIP program, together with the OSS, NTSC-A and the Naval Command System Integrated Tactical Environment subsystem, comprise the JMCIS as part of the GCCS. The software program will emphasize the use of standards to achieve interoperability with other component of the JMCIS and the GCCS.

Navy Command and Control System Ashore (NCCS) Ashore. NCCS provides the primary command and control systems for Navy decision makers ashore. CINCUSNAVEUR is supported by this system. Its three major components are the Operations Support System, the Ocean Surveillance Information System (OSIS) Baseline Upgrade (OBU), and the Tactical Support Centers (TSCs).

Navy Command and Control System Ashore (NCCS Ashore) Upgrade. This project incrementally develops and upgrades three components of the NCCS Ashore system: the Shore Targeting Terminal (STT) Improvement, the Force High Level Terminal (FHLT) Improvements, and the Modernized NCCS Front End Processor (MNFEP). The STT and FHLT support Submarine Operating Authorities (SUBOPAUTH) and the ashore ASW Sector Commanders respectively while the MNFEP project is the communications processor supporting all NCCS Ashore nodes. Upgrades are required to support: increased data transmission rates, improved submarine fire control systems, expanded interface requirements, and replacement of antiquated 1960s systems. STTs support submarine force commanders in planning and directing submarine operations and promulgating surveillance data for OTH-T. FHLTs support ASW force commanders in executing maritime patrol and open-ocean reconnaissance responsibilities. FHLT systems provide message processing and organization aids, integrate own and hostile force information for situation monitoring and assessment, and planning and resource allocation aids.

Navy Extremely High Frequency Satellite Communications Program (NESP). NESP is the Navy's part of the tri-Service Milstar SATCOM program. Milstar will provide survivable wartime command and control communications for designated commanders and their assigned forces. The EHF SATCOM terminals will enable jam-resistant, low probability of intercept, minimum essential communications in hostile electromagnetic environments well into the next century. These capabilities are achieved through narrow beamwidth antennas, high effective radiated power, and extensive signal processing. Survivability of the system is enhanced by nuclear hardening of some of both the ground and the space-

based segments, distributed satellite constellation control, and space-based, computer-controlled, autonomous satellite cross-links. The system will also provide a jam-resistant EHF Fleet Broadcast uplink which will be automatically cross-banded in the satellite to a UHF downlink of parameters, allowing reception on current AN/SSR-1 satellite Fleet Broadcast receiving equipment.

Navy Network (NAVNET). NAVNET is a subset of the DISN-NT consolidation effort. It is a worldwide Navy network, comprised of 31 nodes. Long-haul connectivity is provided through the use of leased facilities, usually by T-1 trunks.

Navy Tactical Command System–Afloat (NTCS–A). NTCS–A is the primary afloat segment of the Navy Command Control and Intelligence System. It is a combination of hardware, software (applications), and personnel that is one of the pillars for the Navy's COPERNICUS Architecture. NTCS–A is also an integral part of the Navy's Joint Maritime Command Information System (JMCIS) and uses the Navy's Unified Build (UB) core of command and control process applications. (UB Core: Incoming Communications Manager, Outgoing Communications Manager Graphics Manager, Tactical Plotter, and Tactical Data Base Manager). The system is operable, state of the art, and is based on a GOTS/COTS open architecture.

Navy Tactical Data System (NTDS). NTDS is an automated combat direction system developed to address the anti-air warfare problem by automating the shipboard combat information center. It is presently aboard over 200 active ships, including carriers, cruiser, destroyers, frigates, and amphibious ships. It is composed of various combinations of digital computers and associated data processing equipment, displays, and communications data links. Eventually NTDS is planned to be replaced by the Advance Combat Direction System (ACDS).

NDL Integrated Data System (NIDS). NIDS combines target island construction, DGZ construction and DGZ coding functions into a single interactive graphics system. Automated SIOP Allocation (ASA). ASA automates the allocation of ICBMs and SLBMs to targets.

Newsdealer (supported by AUTODIN) (Newsdealer). Newsdealer was developed to support the message switching needs of the CRITICOMM network. It provides for CRITIC, SI, and privacy communications dissemination. It has store and forward message switch capabilities similar to the AUTODIN that is used to handle sensitive compartmented information. The functions of message routing, intercept, alternate routing, and first-in/first-out by precedence, among others, are available through Newsdealer.

Non-Cooperative Target Recognition (NCTR). NCTR devices provide positive identification of aircraft for air defense weapons systems operators. They compliment cooperative IFF systems and permit operations at extended ranges while reducing the risk of targeting friendly aircraft. The devices consist of a sensor, processor, and digital display deployed on an

individual air defense weapons system. Two models are in development. They will be integrated into the AVENGER, GBS, and HAWK weapons systems either individually or in combination consistent with battlefield requirements

North American Defense System (NADS). The NADS is a system of systems whose primary role is the detection of an attack upon North America, from Space, Air-breathing and Ballistic missile weapon systems. The Space Surveillance Network (SSN), the North Warning System and the PAVE PAWS systems are examples of components to the NADS. Warning of attacks are released from NORAD Hq through several support networks.

NTCS-A/NCCS-A Integrated Tactical Environmental Subsystem (NITES). NITES is being designed to operate within the Copernicus Architecture as a NTCS-A subsystem. Existing communications assets will be used to transmit highly-compressed, digital meteorological and oceanographic (METOC) data to virtually every platform. The user-friendly NITES software, which is embedded within the NTCS-A, will decode decompress, manipulate, and display this METOC data in a variety of forms, e.g., wind and seas warnings, radar refractivity conditions, and the location of oceanic fronts and eddies. NITES requires no trained oceanographers or aerographers either to operate the equipment or interpret the data products. The NITES frequently updated, high resolution database will be continuously available for automatic access by C4I, mission planning, and sensor/weapon performance assessment systems. Any workstation on the NTCS-A LAN will have access to the NITES data for tactical decision aid inputs.

Nuclear Planning And Execution System (NPES). The NPES provides an information database on nuclear weapons, supports nuclear planning and operations, and provides nuclear operations decisionmaking data. It also provides information on force readiness assessments, execution planning and monitoring, attack characterizations, residual threat assessments, force recovery, mission planning, and reconstitution support.

Ocean Surveillance Information System (OSIS) Baseline Upgrade/OBU Evolutional Development (OBU/OED). The OBU System is a shore–based, on–line, Automated, near– real–time netted command and control system. It receives, processes, and disseminates to the Navy and other services, at all levels of command, timely all–source ocean surveillance information on targets of interest above, under, and on the surface of the oceans.

Office Automation Local Area Network (LAN)/Management Information System (OA LAN/MIS). Provides for operations, maintenance, system administration and further implementation of the Unclassified and Secret administrative LANs supporting USSTRATCOM Manages Defense Data Network (DDN) connectivity for all USSTRATCOM agencies. Provides interface with air staff for program objective memorandum (POM) input and Offutt AFB administrative functions. Interfaces beyond the base gateway for world-wide information requirements. Supplies Headquarters automated data processing (ADP) training courses (mainframe and PC), ADP data administration, software engineering, software

and hardware security, common Ada compilers, commercial-off-the-shelf software development, and hardware and software maintenance Supports all J-staff requirements for training on standard office automation equipment and applications development, modification and maintenance.

Office Information System (OIS). The OIS is a wide area network of office automation systems: computer hardware/software, terminals, printers, and file servers. The OIS is AMC's automation system/services to create, transfer, share, and present both command and control and office information electronically, using networked personal computers and commercial, off the shelf software. Specified users can configure their personal computers to access mission support command and control information. OIS is used throughout the entire staff, from the command section to the action officer and secretarial level. The OIS is a wide area network of office automation systems: computer hardware/ software, terminals, printers, and file servers. The OIS is AMC's automation system/services to create, transfer, share, and present both command and control and office information electronically, using networked personal computers and commercial, off the shelf software. Specified users can configure their personal computers to access mission support command and control information. OIS is used throughout the entire staff, from the command section to the action officer and secretarial level.

Officer-in-Tactical-Command Information Exchange System (OTCIXS). The OTCIXS provides two-way UHF SATCOM intra- and inter-battle Group communications links for teletype traffic and computer-to-computer targeting data. It is a battle group oriented C2 net for battle management and force coordination as required by the OTC. The network supports ship-to-ship high speed teletypewriter and tactical record RAINFORM GOLD exchanges, including event-by-event track updates and OPSNOTE narrative traffic.

Officer in Tactical Command Information Exchange Subsystem II (OTCIXS II). The principal purpose of OTCIXS II, a software package, is to rectify the shortcoming of the current OTCIXS network protocol not being DAMA compatible. OTCIXS II development is designed to provide subscribers with a communications network that will function in both DAMA and non-DAMA modes, while providing at least the equivalent of or better service than the existing OTCIXS. Like the present OTCIXS subsystems, this second generation enhancement of the OTCIXS network will provide suitably-equipped surface ships, submarines, and shore sites with the capability to exchange OTH-T information more efficiently.

Operational Secure Communications (OPSCOMM). OPSCOMM is used to provide analyst-to-analyst communications to meet operational requirements. Message traffic is normally conversational in nature. OPSCOMM is the generic name given to those intelligence communications circuits used to transmit information other than formal (formatted) messages. Its circuitry is used for man-to-man , man-to-machine, and machine-to-machine exchange of analytic data.

Operations Support System (OSS). It is a single, integrated, distributed C2 system utilizing NDI and COTS hardware, and wherever possible, software. The principal functions to be performed by OSS are to provide a real-time capability to receive, process, display, and assess readiness, warfighting capabilities and disposition of own and allied forces, and to manage the allocation of their resources, including communications gateways to the fleet commander, a significantly improved briefing and planning support and database management capability, and expert system enhanced decision and planning aids.

OUTBOARD II. OUTBOARD is an organic system that provides the operational commander with a real-time passive capability to detect, locate, track, and target hostile units at long range (OTH). OUTBOARD provides Fleet Commanders with an organic cryptologic sensor exploitation and resource management capability. OUTBOARD is procured in two phases. OUTBOARD I consists of a DF system, a Countermeasures (CM) Receiving System, a System Supervisor Station Communication Control Group (SSS), Local Monitoring Station (LMS), SI Communication Systems, including TACINTEL. OUTBOARD II is an upgrade to existing OUTBOARD I installations, consisting of an Automated Narrowband Acquisition, and SSS Modification Kit. The CM system, automated narrowband acquisition system, and LMS provide the basic signal detection and recognition capability. The DF system provides direction to assist in targeting. The SSS coordinates and directs the efforts of the OUTBOARD subsystems and provides an interface to the Combat Information Center (CIC) and to other offboard cryptologic systems such as OUTBOARD, COMBAT DF, SSES, and the HFDF BULLSEYE net.

PAVE PAWS. The mission of the PAVE PAWS system is to detect, track and identify SLBMs launched against the North American continent and provide warning data/assessment information to USSTRATCOM, NMCC and other user agencies. The system complements DSP (and future ALARM) by providing dual phenomenology of an attack. Dual phenomenology is the receipt of TW/AA information from two different sensor systems which are physically separate with totally different scientific bases. Dual phenomenology adds confidence to the decision makers that a single, system unique error is not providing a false alarm. This system is composed of several types of radars located around the periphery of the CONUS. PAVE PAWS includes four dual faced phased array radars (Cape Cod and Beale. AN/FPS-115) (Robins and Eldorado-AN/FPS-123) and associated equipment providing warning and attack assessment of an SLBM attack against the CONUS, Alaska and Southern Canada. The secondary mission is to provide warning and attack assessment of ICBM attack against the above areas. PAVE PAWS transmits this data directly to CMC, NMCC and USSTRATCOM.

Personal Communications System (PCS). The Personal Communications System is a new commercial service type which will exploit new telecommunications satellite technology. Small hand-held communications transceivers similar to current cellular

telephones will provide the warrior with immediate long-haul connectivity for paging, voice communications, and low capacity data transfers.

Pilot Accelerated Architecture Acquisition Initiative System (PA3IS). The Pilot Accelerated Architecture Acquisition Initiative (PA3I) System is designed to support improved connectivity and access to imagery-based intelligence products by both producers and end users. The PA3I architecture is being implemented as a pilot program at four intelligence centers: USCENTCOM (Building 213); DIA; USACOM; and NMJIC. Connectivity to the organizations supported by the four intelligence centers is provided through the Joint Worldwide Intelligence Communications System (JWICS) network, the Defense Information System Network/Secret Internet Protocol Router Network (DISN/SIPRNET), and the TROJAN Data Network. The PA3I project is a major step toward an open, distributed United States Imagery Systems (USIS) architecture that greatly enhances the ability to locate and exchange data. A guard capability permits the transfer of collateral and downgraded products from the SCI LAN to the Collateral LAN for access by the war fighter via the SIPRNET and TROJAN networks.

Position Location Reporting System (PLRS). Provides a portable means to assist in land navigation and simple (10 character) message transmission. Also provides the commander a means to determine subordinate unit location without reporting through normal channels.

Processing and Display System (PDS). The PDS is a component of the Cheyenne Mountain Upgrade (CMU) Command Center Processing and Display Subsystem - Replacement (CCPDS-R) program. The PDS will be a receive-only terminal device installed in all fixed primary and alternate command centers. This terminal will be capable of receiving correlated data from a correlation center, receiving direct sensor data from missile warning sensors, and processing and displaying the information. Communications will be provided via commercial landline the JRSC System, and Milstar. PDS implementation is planned to be concurrent with the implementation of CCPDS-R

Psychological Operations Automated Data System (POADS). POADS is an automated data base system to assist operations analysts research and plan missions. POADS provides: an all source document index, intelligence report summaries, psychological operations finished intelligence products, global radio and television data base, biographical information, and psychological operations assessments and studies. POADS also has a capability to correspond (send and receive) directly with other POADS users

Range Standardization and Automation (RSA) Program. The RSA will significantly improve the C4 infrastructure supporting launch operations. Limitations in communications bandwidth from downrange tracking locations require use of a process known as "strip-and-ship," whereby the customer Event messages generated by the ground stations are trans-

mitted over a dedicated Ground Communications Network (GCN) to the CCPDS computers located at the NMCC, the CMC, the USSTRATCOM Command Center, and to several secondary users. At USSTRATCOM, the CCPDS provides warning information by processing the surveillance data with force status and intelligence data. PCL Decision Time Remaining (DSNTR) is calculated and displayed. The ALERT is an advanced follow-on system to DSP.

Rapid Application of Air Power (RAAP). Provides the targeting database and software applications to support air combat targeting at the theater–level and below. It will support the Air Operations Center to develop, weaponeer, and nominate targets for attack by air assets, and achieve the objectives of the commander's strategy. Two versions exist: one integrated into CTAPS at the AOC and an in–garrison version resident within sensitive compartmented information facilities.

Red Switch Project (RSP). This program provides automated secure voice service to command and control users at the NMCC, ANMCC, CINC Command Centers, and other key command locations.

Regional/Sector Operational Control Center (ROCC/SOCC). The ROCCs and SOCCs provide for surveillance, identification and control of aircraft in the North American, North Atlantic, and North Pacific airspaces. Operationally, all ROCCs and SOCCs in CONUS, Alaska, and Canada are directed by CINCNORAD.

Rehosted CAFMS (RCAFMS). Provides automation to the combat plans and combat operations divisions for the command and control system architecture in the JFACC to plan and execute the Air Tasking Order (ATO). Has the following capabilities: a) Construct, review, and disseminate the ATO; b) Generate operational mission schedules; c) Follow mission progress; and d) Monitor Modular Air Operations Center resources.

Relational Analysis of Internetted Linkages Subsystem (RAILS). RAILS provides the capability to load, display and manipulate the Air Force Electronic Warfare Center's CONSTANT WEB C3CM database. RAILS controls the actions required to maintain and exploit information related to the C3 of selected foreign powers. Most applications provide both textual and geographic depictions of units, communication networks and installation data including the capability to selectively print on-line displays and background reports. Analysts have the ability to perform MIIDS database maintenance and designated production tasks, carry out exercise/event analysis and develop critical node analysis processing (e.g., C2 network structure at any echelon, the chain of command for any unit at any level, all communications available to a C2 authority, etc.). This information is used to avoid C3 nodes or identify critical defensive C3 nodes which can be degraded by electronic jamming or targeting.

Relocatable Target Area Planning System (RTAPS). RTAPS provides automated support for tracking mobile land based ICBMs and other targets based upon fused, multi-source intelligence data concerning likely deployment areas. Analysts use RTAPS data for area limitation studies.

Requirements Management System (RMS). RMS is a redesign of the Committee on Imagery Requirements and Exploitation, Automated Management System, and Advanced Imagery Requirements and Exploitation System capabilities. It comprises a suite of Compartmented Mode Workstations and servers sized to accommodate the projected workload. RMS is the imagery component associated with the Collection Requirements Management System.

Route and Penetration Evaluation System (ROPES). ROPES is an integrated system providing automated penetration and attrition analysis for air breathing offensive weapon systems given the effects of the defensive environment. It supports tactics, threat and force application evaluation for SIOP, limited nuclear options, reconnaissance, contingency plans, war gaming and associated studies. ROPES includes the ability to process a single sortie, part of an attack option, or an entire attack option. It also provides for single sortie processing on-line, while batch processing can perform single or multi-sortie processing.

Scalable Transportable Intelligence Communications System (STICS). This NSA sponsored program is designed for ease of deployed communications. STICS is a lightweight deployable UHF SATCOM terminal (LST-5) secured by KY-57 cryptographic equipment. STICS will be used to connect the Joint Special Operations Task Force (JSOTF) and other SOF deployed elements, as required.

SCAMPI. SCAMPI is the principle C3I system for USSOCOM. Transmission of data between SCAMPI nodes is over a network of Defense Commercial Contracts Office (DECCO) leased, fiber optic, Tl, wideband, commercial data lines. Secure voice and various data information are integrated into data streams using multiplexers and then secured with one or two levels of encryption.

Sealift Strategic Contingency Planning System (SEASTRAT). SEASTRAT provides MSC with the capability to develop movement tables rapidly from TPFDD inserted during the deliberate planning process. It also assists in the development of movement schedules for execution and performance of transportation feasibility analyses.

Secondary Imagery Dissemination Systems (SIDS). The SIDS is used to transmit, receive, and manipulate secondary imagery. Secondary imagery is received from national sources, processed by theater analysts, and disseminated to tactical users. Three specific systems are used by the preponderance of DOD tactical elements. The Portable Remote Telecommunications Systems (PORTS) is a PC-based workstation that provides image processing and text editing functions through a software interface. The Fleet Imagery Support Terminal (FIST) is capable of simultaneous transmission and reception of high-quality, digital imagery using secure UHF communications satellite or landline media. The Image Communications and Operations Node (ICON) is used to receive, enhance, analyze, and annotate color or black and white imagery for secondary dissemination to tactical elements.

Secret Internet Protocol Router Network (SIPRNET). Replaces the DSNET-1 in migrating to the DISN. It operates at the SECRET Collateral level and can interface with the TROJAN network. It provides higher and selectable data rates at a much lower O&M recurring cost. Inter-site data rates are 512 Kbps and in some cases T-1. Users can connect to the network at selectable data rates that meet the need.

Secret Personal Computer Local Area Network (SPL). The SPL provides a basic capability consisting of headquarters wide communications with standard software interfaces and applications. The SPL serves as a communication platform to distribute information, manage data, and coordinate positions in times of peace, crisis, and contingency operations. Communications include asynchronous connections to other similar networks, remote nodes, and DSNET 1. It offers electronic mail, database applications, staff automation tools, and standard office automation commercial off the shelf applications.

Secure Mobile Anti-Jam Reliable Tactical Terminal (SMART-T). SMART-T is an Army EHF program for development of ground terminals to operate in the Milstar/EHF system. SMART-T will satisfy a critical need for an extremely reliable, extended distance, mobile, secure tactical communications capability. SMART-T will process data and voice communications at medium or low data rates. It will provide a range extension capability to the Army's MSE in support of Air-to-ground operations, specifically by providing an EHF SATCOM interface to permit uninterrupted communications as advancing forces move beyond the LOS capability of MSE. The SMART-T emphasizes rapid set up/tear down, and interface with the Army Common Users System, Army Data Distribution System, and commercial systems.

Secure Telephone Unit 3rd Generation (STU-III). The STU-III is a telephone desk set usable as both a secure telephone and an unsecure administrative phone for designated users of common user telephone systems. The STU-III is not compatible with the Advanced Narrowband Digital Voice Terminal or Digital Switched Voice Terminal except through a Red Switch. It can also be used as a data modem to connect secure facsimile machines or to connect remote personal computers to mainframes. The STU-IIIA is compatible with the STU-II/B used by NATO.

Secure Voice System (SVS). The SVS program refers to the DCS system which uses digital secure narrow band voice technology to replace the old wide band AUTOSEVOCOM for greater efficiency and economy of transmission bandwidth. The Secure Voice Architecture (SVA) for STU-III and Defense Red Switch Network (DRSN) installations and connection is designed to provide a capability to meet requirements of the NCA and subordinate commanders under various war fighting environments. (See STU-III and DRSN). A third portion of the SVS, the Secure Conferencing Project (SCP), has been canceled.

SENTINEL BYTE. SENTINEL BYTE is an Air Force standardized architecture to link command C4I Systems at the unit level and to automate intelligence office functions. It establishes a secure network of computers among the USAFE Wing Operations Center, Alternate WOC, and Squadron Operations Centers. It passes intelligence, weather, and tasking information directly from the wing to each squadron for analysis and mission planning. Provides intelligence data base and software applications to support unit level air combat operations requirements, e.g., mission planning, pilot/aircrew pre/post mission briefings/debriefings, reporting, pilot/aircrew training interfaces with CTAPS and AFMSS, and provides full JDISS functionality at the unit–level. Provides secure intra–base connectivity between remote nodes on overseas sites and access to theater and force–level all–source threat databases. Will allow unit personnel to maintain order of battle and target information. Data formats conform with DIA's integrated data base transaction format (IDBTF). Directly receives near–real–time ELINT updates from CS. Allows the use of IMOM in supporting route planning with threat to terrain analysis.

SHF Replenishment. The SHF Replenishment program will supplement current DSCS communications capability through the development of modular satellites and communications packages. The modular satellites will carry any one of four payload designs on a medium launch vehicle to geosynchronous orbit. The four payloads are EHF, SHF, UHF, and crosslink packages.

Shipboard Non-tactical ADP Program (SNAP III). An integral component of the Naval Tactical Command Support System (NTCSS), SNAP III is a tactical support system that provides shipboard inventory management, financial management, maintenance data collection, equipment configuration control and administrative (personnel, medical, etc.) functions. SNAP III is being installed on all US Navy ships and submarines, and at deployable Marine Air Logistic Squadrons (MALS).

Shore Targeting Terminal Upgrade (STT Upgrade). The STT involves improvements to communications handling using a front-end processor and software developed by Naval Ocean System's Center, and a message processor (MP). Enhancements will accept messages formatted in OTH-GOLD, Joint Interoperability of Tactical C2 Systems, residual RAINFORM, and free-form operator OPNOTES from the MNFEP via an Ethernet interface. It provides for the Automatic Input Processing and other correlation routines that are to be off-loaded along with the positional calculation function. A virtual terminal concept will be implemented by establishing an Ethernet link allowing logical configuration changes. It will bring the STT to full Submarine Operational Command Center (SOCC) capability.

Single Channel Anti-Jam Manportable Terminal (SCAMP). The SCAMP Block I provides a manportable, secure, AJ, single channel low data rate EHF worldwide voice and data SATCOM terminal. This user owned and operated 30 pound terminal meets a critical need for C2 in an EW environment. The system operates in an intense jamming environment,

having LPI/LPD with interface to the Area Common User's System (ACUS). The SCAMP Block II will provide a manpackable 12-15 pound terminal to the tactical soldier.

Single Channel Ground and Airborne Radio System (SINCGARS). SINCGARS is a family of VHF-FM (30-88 MHz), frequency-hopping, jam-resistant, combat net radios which provide the primary means of C2 for infantry, armor, and artillery units. The SINCGARS system is designed on a modular basis to achieve maximum commonality among various ground and airborne system configurations. The SINCGARS family of radios has the capability to transmit and receive voice, tactical data and record traffic messages, and is consistent with NATO interoperability requirements. Developed by the US Army for voice and data communications, SINCGARS is being incorporated by the Navy into a HAVE QUICK/SINCGARS version of the AN/ARC-182 radio to provide interoperable AJ protection in the VHF-UHF bands using one radio (Combo Radio, designated the AN/ARC-210) for use in aircraft.

SIOP and Red Integrated Strategic Offensive Plan Gaming. The gaming uses a detailed, two-sided, interactive, strategic nuclear exchange model used to evaluate the SIOP. It simulates war plan execution using actual SIOP sorties against application of Red forces. Flexibility includes variations in force structure, timing and execution sequence. It produces a detailed summary of the outcomes of each weapon and weapon-system of both sides. It performs damage an analysis for all target and probable casualty figures.

SIOP Monitoring (SIMON). SIMON is a laptop computer based information management system that provides weapon status information and sortie generation schedules to ABNCP battle staff members. The system includes capabilities for SIOP force status briefings and mapping functions.

SOF-MOSS. SOF-MOSS is a low-level, Communications Intelligence (COMINT)/ Direction Finding (DF) network. COMINT data will be automatically transmitted from the team level via a long-distance, LPVD link to a base station at the Forward Operating Base (FOB)/Special Forces Operating Base (SFOB) level. The analysis of the intercepted data will provide immediate threat information.

SOF Intelligence Vehicle (SOF-IV). The SOF-IV is a deployable, automated, multisource, near-real- time, intelligence system that is interoperable with theater Intelligence Data Handling Systems (IDHSs), SOF intelligence systems, and national assets. SOF-IV extends the capabilities of the Special Operations Command Research and Threat Evaluation System (SOCRATES).

SOF Laser Acquisition Marker (SOFLAM). Small, lightweight laser marker capable of marking point targets to 8 km for laser-guided bombs and range finding to 10 km.

SOFTEC. A system planning, management, and self-diagnostic technical control capable of automated testing, monitoring, and conditioning analog circuitry in support of JSOTF headquarters operations at theater-level. At a later date, SOFTEC will have a digital capability, standardized architecture to link command C4I Systems at the unit level and to automate intelligence office functions.

SONATA. SONATA is a composition of three major themes in support of the Navy's Space and Electronic Warfare (SEW), including global C4I. The "World View" is a global perspective of the changing nature of war and the Navy's response to it. The Copernicus Architecture provides a strategy for Navy to build a C4I system in the Information Age with new doctrine, organization and technical standards. A subset of the Copernicus Architecture is the Navy support to the GCCS. The Croesus Strategy addresses the problems of fielding information systems technology in the midst of changing threat, exploding technologies and declining budgets.

Sound Surveillance System (SOSUS). The SOSUS is primarily an ASW surveillance system which observes and tracks hostile underwater and surface threats by correlating sound signatures emanating from the targets of interest. The SOSUS is an important component of the overall Ocean Surveillance System.

Space Defense Operations Center 4 (SPADOC 4). USSPACECOM's SPADOC 4 will automate many space defense and surveillance functions and significantly improve the space control support SPADOC provides to combatant commanders. The MCCS will provide survivable communications/data processing upgrades for the MCCC. It provides core Automated Data Processing (ADP) and survivable communications. Communications improvements include DSCS/Jam-Resistant Secure Communications (JRSC) terminals, a Milstar Terminal and Control Element, and semi-automated communications control. ADP improvements include Battle Staff ADP which include missile warning, C2, space intelligence, and special activities processing. Phase II includes modular upgrades to include NUDET processing, terrestrial communications, remaining mission area ADP software, and a permanent garrison facility. Communications are being provided via commercial landline and the JRSC System.

Special Intelligence Communications (SPINTCOMM). The SPINTCOMM provides SI record and privacy traffic dissemination. It is a network of a dedicated family of circuits, terminals and facilities that serve the Special Security Office (SSO) functions at most major headquarters worldwide. SPINTCOMM traffic is generally switched by the local Streamliner processor and/or the nearest AUTODIN switch. It can process all precedence of traffic that include codeword, CRITIC and privacy messages, when so configured.

Special Operations Command, Research, Analysis, and Threat Evaluation System (SOCRATES). SOCRATES is the baseline USSOCOM Intelligence Data Handling System (IDHS) and provides a wide range of mission-directed, automated

intelligence and imagery support to USSOCOM, component headquarters, and USCENTCOM (in garrison). SOCRATES is projected for USSOCOM mission support units, theater SOCs, and forward-deployed SOF. SOCRATES is being extended in an SCI LAN Extension and Stand Alone capability configuration. The SCI LAN encompasses a full suite of SOCRATES equipment, including workstations, secondary imagery dissemination systems, and a mapping and graphics capability. The Stand Alone capability provides a work station with tailored data bases specific to unit operational orientation. Stand Alone capabilities are being provided to Guard and Reserve units as well as to certain active, lower-echelon units.

Special Operations Forces (Data/Supply) Base (SOFBASE). SOFBASE is an automated management system providing information on non-standard, low density SOF equipment, parts, and supplies using LANs and WANs. Supply functions include the ability to determine the availability of items maintained in joint operational stocks, as well as cost and repair histories of equipment. The system also provides the capability for electronic mail links through the SOF community.

Special Operations Forces Planning and Rehearsal System (SOFPARS). This is a USCINCSOC sponsored initiative to develop a computer based planning and rehearsal system that meets the unique requirements of the air, ground, and maritime elements of SOF. The system will provide a modular, automated and timely means of efficiently processing critical mission support data while enhancing the ability to respond to events worldwide in a timely and effective manner

Special Operations Forces Tactical Assured Connectivity System (SOFTACS). SOFTACS will field an integrated and balanced suite of communications systems designed to support the high-capacity, digital, secure, interoperable transmission and switching requirements of emerging SOF command, control, communications, computer, and intelligence systems. SOFTACS will provide significantly increased information transfer capability to deployed SOF.

Standard Army Ammunition System (SAAS). Provides the Class V (munitions) managers from plant (wholesale) to gun (retail) with the capability to optimize allocation and use of scarce logistical ammunition resources and to meet the needs of the tactical force commanders for planning during deployment, redeployment, reconstitution, retrograde, and airland operations. SAAS will be used by all ammunition supply related activities in the active Army, Reserve, and National Guard.

Standard Army Maintenance System (SAMS). SAMS is designed to automate day-to-day weapon system and subcomponent readiness status and maintenance information and management functions from the tactical Direct Support (DS)/General Support (GS) level maintenance/Aviation Intermediate Maintenance (AVIM) activities through the non-tactical installation/TDA activities to MACOM/Theater Maintenance program operations. It automates work request preparation,

management information reports and key Class IX supply functions. Requisitions, status and work order parts relationships are prepared automatically through the SAMS/SARSS interface.

Standard Army Retail Supply System (SARSS). SARSS is the Army's standard supply system for all retail users (e.g. active, reserve, national guard, and installation/TDA). It is an Army Acquisition managed wartime as well as a peacetime sustaining base system. It consists of interrelated, hierarchical modules, which operate at different management levels, in both tactical and non-tactical environments. SARSS provides standardized, automated stock record accounting and supply management for Classes II, III (Package), IV, VII, and IX (less COMSEC) within the theater of operations and CONUS.

Standard Theater Army Command and Control System (STACCS). STACCS is a peacetime and go-to-war system, primarily aimed at assisting a theater commander in the execution of crisis and wartime EAC sustainment and operational maneuver functions. STACCS also interoperates with the Global Command and Control System, sister services, multinational and ATCCS BFACs/ABCS and other command and control systems. Applications programs developed by AWIS, STACCS, and CSSCS(EAC) will provide the building blocks for the Army Global Command and Control System (AGCCS). It supports end-to-end force tracking, rear area theater Army operations, and theater sustainment functions. It uses packet switched technology for the wide area network, sharing common data bases and using Army standard hardware and software

Status of Resources and Training System (SORTS). SORTS provides information concerning the status, location and readiness of US worldwide military units. It provides for the registration of each unit of the US armed forces and many other foreign and domestic agencies.

STRATCOM Command and Control System (SCACS). This system includes all key components of the command's C2 network. Elements include the command center, ABNCP, CMAH, planning centers, communications systems, etc.

STRATCOM Intelligence Network (SINET). The SINET serves as the backbone communications network between all components of the STRATCOM IDHS. It provides high speed secure, local area networking (data) and associated value-added capabilities (print/plot, graphics, mail, file server, etc.) for USSTRATCOM intelligence projects and interfaces. It provides communications with the external intelligence community via the DSNET 3 portion of the DDN. SINET provides for future growth to allow distributive processing and control the operation of intelligence data flow beginning at interface units and gateways that separate the host, work stations, LANs or other local sub-networks from the SINET and server/segment hardware and software. It is secure at the Top Secret SCI system high level.

Strategic Automated Command and Control System (SACCS). The SACCS is a dedicated, secure, day-to-day data network that collects, processes and displays information and disseminates operational directions to USSTRATCOM assigned force wing command posts and missile LCCs. SACCS is the primary data system (in a benign environment) for the dissemination of USCINCSTRAT's force survival and PCL messages. Additionally, SACCS provides USSTRATCOM, USTRANSCOM and ACC the capability, in a non-stressed environment, to receive force status record data in NRT for analysis and display. The system provides automated information submission assistance; high speed secure transmission, either by its own dedicated 4800 bps circuitry or via the AUTODIN; automatic message routing, to include IEMATS messages; automatic message processing; and automated information display, either on wall screens or work station displays. The system processors, in addition to providing an interface to IEMATS and the AUTODIN, interface the USSTRATCOM CCPDS and its follow-on replacement; portions of the SWPS, including the SIOP; and the WWMCCS.

Strategic Deployment System (STRADS). STRADS enables MTMC to rapidly retrieve, process, analyze, and monitor data associated with mobilization and deployment for planning purposes and during military operations. It allows MTMC to conduct transportation analyses of OPLANs, provide automated interfaces with other transportation systems, and assist in the development of closure estimates and execution monitoring.

Strategic Mating and Ranging Program (SMARP). SMARP plans the bomber front-end and supporting tanker sorties to meet mission fuel demands given an initial force and resource position.

Strategic Mission Data Preparation System, Phase III (SMDPS III). SMDPS III programs consists of four major projects: the Nuclear Planning and Production System (NMPPS), consisting of hardware and software to replace the SMDPS II systems at B-52/B-1B Main Operating Bases (MOBs); the Deployable Strategic Mission Data Preparation Shelter (DSMDPS), to support Secure Reserve Force (SRF) taskings and trans-/post-SIOP taskings at Alternate Reconstitution Bases (ARBs); a B-2 Mission Planning System; and the Conventional Mission Planning and Production Software. SMDPS will be implemented in three segments: Segment-I provides new hardware and software to SAC B-52 units, a deployable SMDPS for ARBs upgrades to unit aircraft tanning process, and secure connectivity from HQ SAC to units. Segment-II provides totally automated mission planning and production capability for B-1B and B-52 units to include real time weather updates. Segment-III provides complete mission planning and production.

Strategic Operations Conference System (SOCS). The SOCS is a dedicated, non-secure, day-to-day voice C2 system designed to provide the primary means for transmitting time sensitive voice information between HQ USSTRATCOM, its battle management elements and assigned forces. In a benign environment, SOCS is the primary voice system for the dissemination of USCINCSTRAT's force survival and PCL messages. Most subscribers have direct dial capability as

well as connectivity assistance from a SOCS controller interface. The SOCS includes and provides: a rapid means of communication between control agencies at all levels of command, voice backup capabilities, access to airborne assets and interfaces to other communications networks, both commercial and military. In addition to DSN and the public voice networks, SOCS can be extended through unit command post UHF radio systems, unit commander's intrabase radio networks and ABNCP ground entry points. The SOCS hosts the Missile Potential Hazard Network, the Aircraft Emergency Conference and various command conferences prior to disruption due to enemy attack. SOCS also supports other USSTRATCOM systems by furnishing network connectivity. Examples are the Strategic Mission Data Preparation System (SMDPS), the Strategic Training Center Network and the USSTRATCOM Digital Imagery Transmission System (E-DITS). Although SOCS is a non-secure network, SOCS can easily interface with STU-III secure telephone for point-to-point voice and data communication.

Strategic Sealift Contingency Planning System (SEACOP). SEACOP provides MSC with the capability to develop movement tables from the TPFDD inserted during the deliberate planning process. It assists in the development of movement schedules for execution and performance of transportation feasibility analyses.

Strategic Tactical Entry Point (STEP). The STEP program is designed to establish a standard set of C4I services (networks) and equipment at selected earth terminals to support the CJTF and component forces. The primary purpose is to provide a seamless interface between strategic and theater/ tactical users by using a combination of SATCOM and terrestrial telecommunications resources. The C4I service include: AUTODIN/DMS; CTAPS; DISN; JDISS; MILNET; AND GCCS. DSCS earth terminals are being upgraded with up/down converters, multiplexers and baseband equipment to increase tactical connectivity.

Strategic War Planning System (SWPS). SWPS consists of a series of software modules/programs that are located on TRICOMS and used in developing a strategic war. This system is linked together through the SIOP Local Area Network (SIOP LAN). A number of war planning processes are performed that include: develop targets, DGZ construction, weapon allocation, missile/aircraft application, reconnaissance planning, war gaming, attrition analysis and timing/documentation. At the conclusion of this process, SSBN data is disseminated to Dahlgren, VA and aircraft/missile sortie data is distributed to bomber, reconnaissance and ICBM units. Bomber units must develop Data Transfer Unit Cartridges (DTUCs) for programming weapon systems and build combat mission folders to assist the aircrew in flying the mission.

Strategic Weapons Planning System (SWPS). Required to develop, validate and produce the single Integrated Operational Plan (SIOP) the nation's nuclear war plan and related products. SWPS is a fully operational system in a contiguous state of change, as a result of changes in the international environment and realignment of US domestic Priorities.

Streamlining Of Information Service Operations Consolidation Study (SISOCS). SISOCS is a subset of the DISN-NT consolidation effort. It is designed to be a CONUS-wide Army network that us used to evaluate ways to streamline the Army Material Command's data processing techniques, centers, and operations. Formerly, streamlining was accomplished by the use of four major Automated Information Processing Centers (AIPCs). Seventeen additional remote data processing installations are being interconnected to the four major centers. Long-haul connectivity will be provided through leased facilities. T-1 trunking will be used for connectivity.

Submarine (SLBM) Adaptive Targeting System (SATS). SATS is a PC based TRIDENT I and TRIDENT II SLBM mission planning system. The functions included in SATS are footprint generation and sequencing, achievability and fratricide testing, EAM message generation and Range Arc construction. SATS provides the user the capability to plan sorties, patterns and Special footprints. In addition to these capabilities, SATS can generate an EAM message worksheet for FGD replanning missions.

Submarine Retargeting System Data Link (SRSDL). The data link provides a direct communications link between USSTRATCOM and NSWCDD, and between NSWCDD and the SSBN CTFs. The data link provides the capability to increase the overall speed of the retargeting process by eliminating any dependency on external communications centers. The SRSDL supports transmission of normal targeting message traffic as well as large databases. Use of accredited encryption devices allows processing to TS SIOP-ESI data. The result is a capacity to automate the exchange of time critical information.

Surveillance And Control Data Link (SCDL). SCDL is a highly jam resistant, modular, LPI surveillance data link for the US Army and Air Force JSTARS system. Its primary function is to transmit surveillance data on enemy ground forces far behind main battle lines from the aircraft to Army and Air Force battle management systems on the ground.

Surveillance Towed Array System (SURTASS). The SURTASS is a seaborne system which augments the SOSUS and other Ocean Surveillance Systems. It is used in the general location of suspected target activity to better track and characterize targets of interest.

Survivable Communications Integration System (SCIS). SCIS is an automated communications and message processor that will use multiple communications media to provide survivable, timely, reliable, and error-free delivery of critical missile warning information between sensor sites, correlation nodes, and forward users through stressed communications environments. The SCIS will eliminate duplicate messages upon receipt. The communications media includes JRSC, Commercial High Speed, and Milstar.

Synchronous Optical Network (SONET). The SONET is at the heart of the future national and international Information Systems. The trunking capacity for a single trunk has been standardized to the Gbps range which will pass interactive full motion high definition, time division multiplexed video with other voice and data services. (Note; the current telecommunications T-1 trunk operates at a speed of 1.544 Mbps.) The heart of the DISN objective architecture is the BISDN service which will emphasize the use of SONET technology and services.

System Planning Engineering and Evaluation Device (SPEED). Provides the Fleet Marine Forces with the capability to rapidly engineer tactical communications systems, providing a means of evaluating system performance prior to installation.

Tactical Air Operational Module (TAOM). TAOM is a modularized, transportable, automated, air C2 system capable of controlling and coordinating a full range of air defense weapons, including surface-to-air missiles and interceptor aircraft. A joint Marine Corps and Air Force program, the TAOM will improve the capabilities of the Marine Corps Tactical Air Operations Central (TAOC), the Air Force CRC, and Forward Air Control Post (FACP). The basic element is the TAOM AN/TYQ-23 which is housed in a standard 20 foot shelter containing all mission-essential equipment (except air search radars and electrical power). Each TAOM is fully mission capable. System capacity is increased by connecting up to four TAOMs via fiber-optic cables. Maximum system capacity, with the exception of operator positions, can be obtained with three TAOMs. The TAOC/CRC/FACP is responsible for the detection, identification, and intercept of hostile air threats. The TAOM will accept inputs from up to four search radars, and digital data links with other TAOMs as well as other Service's and allied air C2 systems. It processes this information and provides the operator with a real-time tactical situational display. The TAOM also has the capability to recommend best weapon systems for engagement based upon target position and weapon availability.

Tactical Aircraft Mission Planning System (TAMPS). Current legacy, aircraft-unique ("stovepipe") unit level mission planning systems are being integrated into TAMPS as the Navy/Marine Corps standard unit level aircraft mission planning system. These legacy systems may include the Tactical EA6B Mission Support System (TEAMS), Tactical Electronic Reconnaissance Processing and Evaluation System (TERPES), Common Helicopter Aircraft Mission Planning System (CHAMPS), AV8B Map, Operator, and Maintenance Station (MOMS), VIPER (ES3) and the V22 and H53 mission planning systems. TAMPS will compliment the other service common mission planning systems (Air Force Mission Support System (AFMSS) and Army Aviation Mission Planning System (AMPS)).

Tactical Combat Operations (TCO). An automated Commander/Operations Officer terminal. Supports the development of courses of action and preparation and dissemination of operational orders and overlays.

Tactical Data Information Exchange Subsystem A Phase IV (TADIXS A Phase IV). TADIXS A Phase IV will provide ocean area and interocean area communication of OTH-T data from shore subscribers to subscribers on afloat platforms using the existing FLTSATCOM resources and dedicated terrestrial connectivity. Shore gateways will interface with other shore gateways, with each gateway being a subscriber in the adjacent satellite footprint. Each gateway will pass received messages that are addressed to a different satellite footprint from one gateway to the other for retransmission to afloat units in it's own FLTSATCOM footprint. The TADIXS subsystem was designed to provide the capability to broadcast TDP data-link traffic on a one-way transmission path from shore sites to fleet-based Navy Cruise Missile Combat Support Systems. The upgrade provides fully redundant, automated gateways at all NCTAMS and at NAVCOMTELSTA Stockton.

Tactical Data Information Exchange System (TADIXS). The TADIXS is used to broadcast OTH-T data to the fleet. It provides one-way shore-to-ship broadcast of tactical targeting information via a computer-to-computer communications link. The primary communications means is UHF SATCOM. Information transmitted over TADIXS A includes the ocean surveillance product addressed to designated naval combatants being supported by fleet intelligence.

TACTICAL DATA LINK A (TADIL A) LINK-11). Also known as NATO Link 11, TADIL A is a netted, two-way, real time, encrypted data link which uses half duplex HF and UHF communications circuits (as well as shipboard UHF satellite circuits) for computer to computer data interface to pass track information management data, command and control information, and status data among up to twenty Navy, Marine Corps, and Air Force net participants. TADIL uses a star net topology with discrete transmit but full receive connectivity.

TACTICAL DATA LINK J (TADIL J)-(LINK 16). TADIL J/NATO Link 16 is the two-way, node less, encrypted, anti-jam digital voice and data link used for JTIDS. The technical functions are those normally included in tactical C3 systems. The half-duplex links will be used for the exchange of real time or near real time data on activities which include air/ground/maritime (surface and subsurface) surveillance, electronic warfare, and intelligence among Army, Navy, Air Force Marine Corps, and NATO units. Up to one hundred and twenty eight units may participate in each net; up to one hundred and twenty eight nets are possible. Use of TDMA allows the link to provide data over its 300-mile nautical range without mutual interference by other users. TADIL J uses spread spectrum and fast frequency hopping techniques, transmits the same information on two successive pulses, and provides a powerful error correction scheme which allows reliable data transmission even if half of the pulses are lost. Transmission characteristics and standards are contained in JCS Pub 6-01.1 and NATO STANAG 5516.

Tactical Environmental Support System (TESS). TESS provides secure, responsive, and endurable environmental support tailored to specific mission requirements of Navy tactical commanders ashore and afloat. TESS integrates data com-

munications, processing, and display technologies to provide Navy commanders with timely and accurate environmental support, including assessments of the effects of the environment upon specific platforms, sensors, and weapons systems. TESS receives data from satellite sensors, NAVOCEANCOM shore activities, GENSER messages, direct operator entry, local sensor systems, and data records. TESS will be deployed on 35 major combatants and at 27 shore sites. Its modular computer system functions as the afloat operational air/ocean master database for the BG. TESS will exchange data with C4I and combat systems in order to provide atmospheric and oceanographic data. This data will be used to make assessments and predictions of these conditions on BG, friendly, and enemy units, sensor, weapons, and communications systems.

Tactical Information Broadcast Service (TIBS) Network Data Link System. The TIBS network uses a UHF secure digital and secure/unsecure voice link, via SATCOM or line-of-sight, to transmit SIGINT data from RIVET JOINT to TIBS Interface ground data link terminals or the TSART. Although data linking ELINT has priority, the TIBS link can be used to transmit SIGINT reports as a backup to the RJ tactical communications media and also to obtain new or timely inflight tasking or mission redirection from authorized tasking agencies via the terminal's secure voice capability.

Tactical Receiver Equipment/TRE-related Application Data Dissemination System (TRE/TRAP Data Dissemination System) (TDDS). TDDS satisfies a multi-service operational requirement for the near real time global dissemination of time sensitive (e.g., threat emitters) surveillance and intelligence information. TDSS provides ELINT-oriented data from remote national sensors to specific users in support of worldwide tactical and strategic missions, focusing on over-the-horizon targeting data. Current user equipment for TDDS includes Navy TRE, Army Commanders Tactical Terminal Hybrid Receiver (CTT-H/R) and SUCCESS radio, and the Air Force/USSOCOM Multi-mission Advanced Tactical Terminal (MATT).

Tactical Reconnaissance Intelligence Ground Station (TRIGS GPF). The TRIGS GPF is the ground processing facility for airborne tactical reconnaissance. The airborne platform (e.g., TR-1) uses a Commanders' Tactical Terminal (CTT) for connectivity to the ground station and to other airborne platforms in the CTT network. This provides long range line of sight propagation path to/from intelligence producers and consumers with the possibility for air-to-air relay of data. The CTT network has the following capabilities: Total communication connectivity; Simultaneous secure data and voice; frequency agile-HAVE QUICK compatible; Anti-jam capable; Full duplex UHF data link using TDMA, FDMA protocol; Lightweight Airborne relays for reliable LOS connectivity; and full MIL-SPEC Tempest certified Field terminals.

Tactical Satellite Communications (TACSATCOM). TACSATCOM is an expression commonly used to refer to US military UHF satellites: AFSATCOM and FLTSATCOM. For day to day operations, non-Navy users are limited to AFSATCOM. The AFSATCOM system provides reliable, enduring, worldwide command and control communications to designated

SIOP/nuclear capable users for EAM dissemination, JCS- CINC inter netting, force direction, and force report back. Additionally, AFSATCOM service is provided to a limited number of high priority non-SIOP users for operational missions, contingency/crisis operations, exercise support, and technical/operator training. The AFSATCOM and FLTSATCOM systems operate in the UHF frequency band and provide low data rate communications (16 kbps or less) for highly mobile airborne, ship borne, and man pack terminals. All UHF satellite requirements for JCS-directed OPLANs will be included in deliberate planning except FLTSATCOM channels for fleet broadcast, FLTSATCOM channels for submarine information exchange, and AFSATCOM regenerative channels for SIOP forces and theater nuclear forces. There are four basic satellite systems used to provide AFSATCOM/FLTSATCOM service; Fleet Satellite Communications (FLTSATCOM), Leased Satellite Communications (LEA SAT), Satellite Data Systems (SDS), and UHF Follow-On (UFO) satellites.

Tanker Mating and Ranging Program (TMARP). TMARP schedules allocated tankers to support time-phased deployments of mission aircraft from their main operating base to forward locations.

Target Development Support System (TDSS). Target development is the identification, selection, classification, coding and prioritization of installations into the NTB. The installations are selected and coded for inclusion into the NTB using rule-based software. These rules are written as statements into the TDSS by the target analyst based on national guidance, internal command guidance and analysis performed by the targeting staff. Coordination throughout the staff ensures guidance is being adhered to and informs other functions of new or changed items.

Technical Architecture Framework for Information Management (TAFIM). The TAFIM provides the integrated guidance that governs the evolution of the DOD's technical infrastructure. It provides the services, standards design concepts, component and configurations which can be used to guide development of a technical architecture that meet specific mission requirements. The TAFIM is independent of data and mission specific applications and forms the foundation for introducing and promoting interoperability, portability, and scalability of DOD information systems. Proper application of TAFIM will: Ensure integration, interoperability, modularity and flexibility; Guide acquisition and reuse; and Speed delivery and lower information technology costs.

Telegraph Automatic Relay Equipment (TARE). As part of the NATO Integrated Communications System (NICS) Stage 1 program to improve voice and message switches, the TARE network has been established as an automatic store and forward message switching system consisting of stored program-controlled switches. The TARE switches are installed at or near major NATO headquarters in Europe, Canada, and the US in hardened or protected facilities. In addition, a TARE switch is located at Latina, Italy to train engineers, operators, and site technicians. TARE switches are interconnected with approximately 50 interswitch trunks and are capable of low speed (50-300 baud) and medium speed

(600-2400 baud) data rates. Some sites are provided with EMP protection. Medium-speed lines and interswitch trunk circuits are protected by digital on-line cryptographic equipment, while low speed lines are encrypted with NATO inventory equipment. The NICS TARE serves both authorized military and political elements of NATO. Designated TARE facilities interchange traffic with telegraph networks of NATO member nations including the US DCS/AUTODIN network. The TARE network can process all classifications of messages, including COSMIC TOP SECRET and special category messages. It recognizes four levels of precedence (Flash, Immediate, Priority, and Routine) and processes messages in order of precedence.

Terminal Management System Export/Import (TERMS E/I). TERMSE/I records cargo data for surface movements at MTMC area commands; receipt, staging, and loading cargo at ports; and generates the ship manifest upon completion of loading. TERMSE/I will be replaced by the Worldwide Port System.

Theater Army Medical Management and Information System (TAMNIS). TAMMIS is an automated, on-line, interactive microcomputer system designed to assist commanders by providing timely, accurate, and relevant medical information. It was developed to manage the medical information of field medical units during peace as well as war. TAMMIS tracks patients and manages medical information at Table of Organization and Equipment field medical units in the corps and echelons above corps. It provides support to the following four functional areas: Medical Patient Accounting and Reporting, Medical Patient Regulating, Medical Blood and Blood Products Management, and Medical Logistics.

Theater Avoidance Mission Planning System (TAMPS). TAMPS is Navy/USMC automated Mission Planning System which was used successfully in Operation Desert Storm. It helped provide common perception through a common threat data base. From the data base one could identify a site and look at its complete history. It could see patterns in target changes. Close to real time data was based on pilot BDA. It effectively supported the deconfliction function. Air crews used the system directly and were supported by a backup team. It was deemed an essential tool in combat operations.

Theater Exploitation of National Capabilities (TENCAP). TENCAP is an intelligence program designed to enhance support to the deployed warrior on the battlefield by providing intelligence information which was obtained by national technical means. Traditionally strategic data will be tailored and made readily available to the deployed forces. Emphasis is on information which is complete, accurate and current, and responsive to the warrior's needs.

Theater Extension Network (TENET). The TENET, a component of the Global Grid program, provides for a significantly expanded communications capability for the future GCCS. TENET is developing technology to provide a secure and survivable

network that extends military communications to those warfighters that cannot be reached by commercial links. It is one of Global Grid's advanced technology demonstrations, which focus on creating a jam-resistant, seamless, gigabit communications architecture. It uses existing network technology to demonstrate that commercial communications infrastructure leased by DOD can effectively extend command and control capabilities to any location around the world. The Services' existing and planned communication systems, like Milstar network, will be critical elements that will fit into the Global Grid network as receivers and transmitters of signals.

Tomahawk Strike Coordination Module (TSCM). Designed to enhance the effectiveness of cruise missile and aircraft strike warfare, the computer-based TSCM is intended to correct mission planning and coordination deficiencies uncovered during the Persian Gulf conflict. The TSCM will permit planners to closely integrate strikes on enemy targets via a variety of weapons systems, including attack aircraft and cruise missiles. Also included will be the capability to map out multiple routes to selected targets to reduce the danger posed to strike aircraft. By collating data from different sensor and intelligence surveillance systems, the TSCM would display a coherent, tactical picture that will significantly reduce the time required to plan coordinated strike operations.

Topographic Set (TOPO SET). A shelterized unit that can create special maps and digital mapping products tailored to a specific mission.

Transport Coordination Automated Information Move System (TC AIMS). A system that provides the MAGTF Commander with an automated capability to plan, coordinate, manage, and execute MAGTF movement from the point of origin to the air and sea POE, and from the Point of Debarkation (POD) to the final destination.

Transport Operational Personal Property Standard System (TOPS). TOPS, a MTMC system, automates the processes and procedures for the movement and storage of personal property for military members and DOD civilians worldwide. It provides the processing and communications necessary for source data automation, ensuring the accuracy and timely exchange of information between personal property offices and finance systems.

Transportation Command Regulating and Command and Control Evacuation System (TRAC2ES). TRAC2ES is a GTN prototype being developed in parallel with other parts of GTN. It will provide global C2 support for patient regulating and evacuation. The requirement for TRAC2ES is based upon directions issued to USTRANSCOM from DOD.

Transportation Coordinator-Automated Command and Control Information System (TC-ACCIS). TC-ACCIS, a Department of the Army system, provides selected US Army Installation Transportation Officers with the capability to maintain current unit movement data, generate rail load plans, and generate bills of lading. It is the Army version of TC AIMS.

Transportation Financial Management System (TFMS). TFMS, a fully integrated system, will handle all Defense Business Operations Fund. Transportation financial requirements to include personnel, payroll accounting, and management information functions. It will ensure the operational, financial, and management requirements of USTRANSCOM and the TCCs are met. TFMS must handle detailed information from three different TCCs which are currently using Service specific systems. TFMS should allow timely access to information with the capability for ad hoc reports which can be pulled by the Office of the Secretary of Defense, USTRANSCOM, and the TCCs.

Transportation Management System (TMS). Enables improved knowledge and control of cargo movement and provides the ability to track, audit, certify, and provide payment for all billings received from the movement of USMC freight, personnel, and personal property shipments. TMS is an on-line application utilizing leading edge technology for timely transactions in the transportation environment. TMS's use of EDI enables communication with the carrier, other regulatory agencies, the supply requester, and the payment center in a completely automated mode, completing the cycle through prepayment audit, voucher certification, and EFT capabilities.

Transportation Reporting and Inquiry System (TRAIS). TRAIS, an AMC management information system, processes transportation data received from CAPS cargo ports worldwide. It provides command transportation management information used to plan allocation of resources and analyze system performance.

Tri-Service Tactical Communications at Army EAC's (TRI-TAC). The TRI-TAC equipment provides mobile communications services for COMMZ tactical forces. The combined TRI-TAC and MSE programs comprise the Army Common User System (ACUS). The TRI-TAC equipment supports the rear areas in support of a Joint Task Force or Army Hq and provides a bridge between the DCS and deployed combat forces. It is normally deployed in a grid structure consisting of switching nodes interconnected by high data rate digital troposcatter radios.

TROJAN. Provides a seamless strategic-to-tactical communications system for Army intelligence support to the warrior. The TROJAN Data Network uses a multi-level secure multiplexer that permits the transmission and receipt of both SCI and Collateral traffic. It provides service to nearly any place in the world provided that satellite connectivity at the proper bandwidth and power are available.

UHF SATCOM Terminal System (USTS). The USTS is an Air Force developed, portable EHF/UHF satellite terminal providing portable, DAMA data and voice communications services for airborne users, fixed ground installations, and transportable elements. USTS terminals may be carried on board C-5, C-130, and C-141 aircraft, mounted for use during flight, and then removed for use on land, on mobile systems, or left on board the aircraft as required. USTS features include TDMA for shared use of 5 and 25 Khz channels on existing and planned satellite transponders, inter

operability with US Navy FLTSATCOM 25 Khz users, a DAMA protocol to increase the availability and connectivity over TDMA, automatic multi-hop routing, support of multi-hop broadcast and point-to-point services, and line replaceable unit (LRU) commonality between the terminals and the Net Control Stations (NCS) to simplify the architecture and enhance supportability.

Unified Local Area Network Architecture (ULANA). ULANA provides an integrated family of LAN components for building tailored local data networks. The components are based on non-proprietary open systems standards and architectures such as the TCP/IP. They provide a migration path to OSI and GOSIP compliance for TCP/IP users.

Uniform Internet Protocol Router Network (NIPRNET). The NIPRNET is the consolidation of several service/agencies networks (e.g., AFNET, NAVNET, MILNET) with common protocols and standards. It is a product of the DISN Near Term Program which sought a reduction in cost of operation through interoperability and standardization. Connectivity over high speed trunking is supported by the NIPRNET. It operates at the unclassified level, while the SIPRNET supports classified networks in a similar manner.

Unit Diary System/Marine Integrated Personnel System (UDS/MIPS). A microcomputer based, fully deployable, personnel data input and report generating system. UDS uses an off-line process to create and transfer unit diaries through the appropriate processing center to update the Marine Corps Total Force System (MCTFS), a central database resident in the Finance Support Activity, Kansas City Center.

Unit Level Logistics System (ULLS). ULLS is a tactical Standard Army Management Information System (STAMIS) which is managed under the Army Acquisition Executive structure in accordance with DOD Directives 8120.1 and 8120.2. All battlefield logistics automation begins with ULLS. ULLS automates organizational level supply, maintenance, property accountability, readiness and unit status reporting functions in tactical units for the active Army, the Army National Guard, and the Army Reserve in both peace and war time. ULLS allows commanders to effectively manage and allocate resources, it simplifies soldiers tasks, it reduces transaction errors, it reduces order-ship time and it helps identify and report materiel excesses.

United States Imagery System (USIS). The USIS is the means by which classified and unclassified imagery can be passed around the intelligence community. There is an interface between the Image Product Archive (IPA) and the USIS using the System II Receive Element. This interface can feed source imagery into the USIS standard exploitation systems which can, in turn, send its image products to the IPA for storage. This interoperability is made possible by the fact that the Receive Element provide interfaces which adhere to the USIS architecture standards

United States Special Operations Command Local Area Network/Wide Area Network (USSOCOM LAN/WAN). The LAN/WAN supports data transfer between the USSOCOM HQ, the USSOCOM Washington Office, Special Operations Command Europe, United States Army Special Operations Command, Air Force Special Operations Command, Naval Special Warfare Command, and Joint Special Operations Command. The LAN/WAN serves multiple purposes to include providing improved ADP to the USSOCOM HQ and the command and control of assigned forces.

Universal Modem. The Universal Modern is a joint Service program to provide interoperable SHF voice and data satellite communications in jamming and nuclear scintillation environments. The Universal Modem will replace the JRSC USC-28 Modems.

Unmanned Aerial Vehicle (UAV). UAV is a remotely piloted vehicle that can be operated via ground control or preprogrammed for autonomous flight with a capability for mid-flight reprogramming. Several types that differ in cost, range, and mission are being developed by the Joint Program Office. UAVs can provide reconnaissance target spotting, battle damage assessment (BDA), and chemical agent detection. By loitering over an area, a UAV can also provide a means for tactical ground communications. UAVs can carry still cameras, electro-optical, IR, radio frequency, and imagery sensors; forward looking IR; electronic countermeasures; and support measures. Plans also call for certain UAVs to carry the ATARS. Near-real-time information transfer from UAVs is usually accomplished by data link or video transmission.

USACOM Theater Intelligence Network (LATIN). The LATIN consists of the IDHS hub located in the AIC, subordinate command IDHS hosts nodes, and personal computer (PC) LANs. LATIN is interconnected via the DSNET3, dedicated encrypted circuits, or via commercial telephone circuits using STU-III encryption. LATIN operates in the system high mode at the TOP SECRET-SCI level. The IDHS provides an accessible intelligence integrated data base (IDB) coupled with data and message processing capabilities. Intelligence information retrieval is available the USACOM Automated Message Processing System (LAMPS), which also provides automated access to national or other command intelligence systems via DSNET3.

USCINCEUR Command and Control Center System (UCCS). The UCCS began as an upgrade to develop and integrate new and existing command and control systems to provide USCINCEUR with a responsive, operational command and control capability during peacetime, crisis, and wartime situations. The goal is to integrate operational, intelligence and logistic information into an automated C2 information system. Capabilities include: USEUCOM decision support system; automated message handling system; briefing and display system; electronic map graphics and map archive system; UHF radio upgrades for USEUCOM crisis satellite communications systems; underground protected distribution system; Top Secret UCCS local area network (LAN); EUCOM Intelligence Support System (EISS) LAN; two way

interface with WWMCCS; one way interfaces with STACCS-Europe and JOTS; and an initial network monitor and control system.

VERDIN. The VERDIN broadcast is a submarine force multichannel broadcast that is of two hours duration for each broadcast schedule. It operates on VLF/LF, providing up to four channels of 50 baud rate by use of time division multiplexing (TDM). The channelization for each transmitting site is unique to that particular site, as the VERDIN channelization is composed at each transmitter facility by insertion of the individual channel keystream provided by the Broadcast Control Authority (BCA).

Washington Area Wideband System Phase V (WAWS-V). The WAWS will extend a bulk-encrypted, digital wideband, terrestrial communications system to link Northwest, Chesapeake, VA, with Washington, DC. WAWS supports such Norfolk, VA subscribers as USCINCLANT, CINCLANTFLT and components, Supreme Allied Commander, Atlantic (SACLANT), NSA, and other Tidewater, VA area subscribers having access requirements with subscribers in the Washington, DC area.

Wide Area Surveillance Tracking and Targeting System (WAST2). WAST2 is a "system of systems" designed to obtain synergy among the various strategic surveillance and tracking systems within the DOD. The objective collection of systems is designed to track space platforms, air-breathing platforms, surface and underwater platforms, and terrestrial mobile platforms. The collection of systems seeks to collate data from acoustic, electromagnetic and visual sources into a composite picture of the target, its state, and attributes.

Wing C2 System (WCCS). The purpose of WCCS is to automate unit battle staffs and key work centers, tying them together in a network. This system, operational with the tactical air forces, adds increased capability associated with force reporting, generation and oversight. WCCS provides information management and decision support to unit–level air operations commanders. Using a single, secure command and control data base and a survivable, distributed network covering all vital support activities, WCCS provides information from all unit support areas to assist the Wing Commander and his staff in making critical decisions and maintaining effective management of battle resources.

Worldwide Military Command and Control System (WWMCCS). The WWMCCS provides the means by which the President, Secretary of Defense, and senior military commanders may receive information pertaining to the need for action by US Military forces and disseminate their decision and orders to those forces. It supports not only the day to day management of the Armed Forces, but is also capable of controlling US forces in a crisis and wartime situations. It consists of five elements: communications, warning, executive aids, command facilities, and data collection/ processing. It comprises those

systems which assure secure and reliable communications between the NCA, the JCS and the unified and specified commanders. It supports the NCA in the execution of the SIOP and other time sensitive operations.

Worldwide Port System (WPS). WPS will be establish a single integrated system to replace four different types of computer systems that currently support the worldwide MTMC and Forces Command terminal management and cargo documentation missions. It will be the primary source for ITV and Total Asset Visibility of surface cargo movement in the DTS both in peace and war. WPS will replace DASPS-E and TERMS E/I.

WWMCCS Allocation Assessment Model (WAAM). WAMM is a computer program developed and maintained for the Defense Information Systems Agency for strategic command, control, and communications study, analysis and evaluation.

WWMCCS Intercomputer Network (WIN). WIN (also known as DSNET 2) is a command and control capability used daily to support operational requirements and provide command, control, communications, and intelligence (C3I) information that enhances the readiness posture of the DOD. It consists of a centrally managed information processing and exchange network consisting of large-scale computer systems at geographically separate locations, interconnected by a wide band, packet switched communications subsystem (DSNET 2). WIN facilitates sharing and exchange of critical command and control information between unified and specified commands. It is designed to serve the corporate information needs of the NCA, and JCS, CINCs, and Services by enhancing continuity of operations, sharing common information, sharing ADP resources, and exchanging command and control information up to the TOP SECRET level through employment of KG-84 COMSEC devices.

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